AUTOMATIC DATA PROCESSING
AUGUST/SEPTEMBER 1959

MARKET FORECASTING ORDER HANDLING ACCOUNTING FINANCIAL AND COST CONTROL DELIVERY SCHEDULING STOCK CONTROL
AUTOMATIC MACHINE CONTROL PROCESS CONTROL DATA RECORDING AND REDUCTION COMPUTING FOR RESEARCH AND DEVELOPMENT

Data Processing

▶ *More Time and Scope for Managers*

▶ *Stores Control in the GPO*

▶ *Keeping an Eye on Credit*

▶ **Full List of Contents Page 1**

Vol 1 Nos 7 & 8

Electronic computers of various types are already in use in considerable numbers in Gt. Britain; but of those developed specially for commercial and industrial accounting applications, the National-Elliott 405 leads the field as the one most widely adopted for carrying out full-scale *integrated* data processing programmes.

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Automatic Data Processing

VOL I Nos 7 & 8 AUGUST/SEPTEMBER 1959

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COVER PICTURE
The setting for the Banco di Roma computer installation

AUTOMATIC DATA PROCESSING
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READING GUIDE

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The problems of the **credit manager** are not readily adaptable to automatic methods of processing data, for they require essentially personal assessment; but there are various ways in which automation can make information more accessible **page 13**

The Post Office supplies department has been operating a Hec 1201 computer for a year on **stores control.** Maintaining a proper check on numerous local supply depots and thousands of stock movements daily has become a practical proposition with this installation **page 18**

One of the great pioneers of electronic computing was the late John von Neumann, professor of mathematics at Princeton Institute for Advanced Study. His book, **The Computer and the Brain,** is here reviewed **page 26**

Computers, centralised in integrated data processing systems, can bring about **more effective management** by virtue of the problems they create in disturbing the present tendency to rigid specialisation **page 30**

An indication of present computer development and the state of current theory could be gauged at the recent **computer conference** at Cambridge **page 34**

Bristol Aircraft Limited has achieved a high degree of **integrated data processing** on IBM punched card equipment, with two IBM 604 calculators. The system includes all the major accounting activities of the company, has saved money and has improved control of the company's finances **page 38**

The **banks have not been asleep** while developments in automation have been taking place: by setting up a committee to develop basic techniques for all banks they have set an example to other businesses **page 41**

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From the Editor to You

Dear Reader,

I have chosen this informal way of writing to you this month because I want to emphasise the personal relationship between those of us who are trying to produce an interesting and valuable magazine and you for whom we are trying to produce it.

The first point I should like to make is that we —plural *we*, not 'Editorial'—don't see the relationship simply as an opposition of producers on one side and consumers on the other. Far from wanting to throw some readymade product at you, whether you like it or not, we want you to help us in planning and producing the most lively, interesting, stimulating and authoritative magazine in this field.

We want this magazine to be useful. How can it be most useful to you? What aspects of data processing most interest you? Are you interested in the wide field of information theory that is opening up, with innumerable portents for industry and science, commerce, and politics?

In the long run, of course, the success of a magazine like this depends upon the willingness of those whom it serves to share their experience with others. Therefore we shall always welcome news of specific data processing methods, whether they are tried and tested in successful applications or are new and experimental variations which have yet to prove themselves.

There is a very natural reluctance to break the secrecy which may conceal something less than an absolutely successful system. Nevertheless at a time when a lot of people are bravely experimenting with computers, it is a pity that their courage does not always extend to being ready to admit and discuss at least some of their mistakes and failures as well as their successes.

Not much is to be gained, in the long run, by trying to deceive ourselves and others by a sort of false optimism which pretends that every failure has been a success or that no serious problems remain to be solved.

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AUTOMATIC DATA PROCESSING

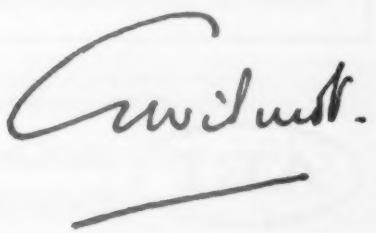
We are interested in data processing simply as a means to efficient organisation in business, and mechanical and electronic equipment is essential to the latest and most advanced techniques in overcoming the problems that are always with us—problems of organisation and communication—which are fundamentally similar in every company, whatever its products or commercial functions may be.

We believe that the first step in solving a problem is to face it squarely and honestly, not to deny its existence. That is why we hope to keep a fairly shrewd and critical eye on the development of automatic data processing, on the claims of manufacturers and on the visions of businessmen. True optimism, we believe, is based on recognition of the facts, unpleasant as well as pleasant.

Of course there is a special responsibility lying with those who are fortunate enough to be in possession of the pleasanter facts—records of successful applications of computers and other automatic data processing installations. It is their responsibility to share their knowledge and experience with the rest of us, so that we can all make progress together.

Very briefly, that is how we view this magazine: as a forum for friends, engaged in the same tasks and interests, anxious to discuss our problems and discoveries, and as a permanent and continuing source of information for all of us who are learning our way in revolutionary techniques of information, which will have—are already having —a tremendous influence in every field of human activities.

Yours sincerely,



Editor.

As a consequence of conditions brought about by the recent dispute in the printing industry, we have been compelled to amalgamate the August and September issues of *AUTOMATIC DATA PROCESSING*. We regret this necessity and offer our apologies for any disappointment or inconvenience suffered by our readers. Subscriptions will be adjusted to compensate for the loss of one month's issue.

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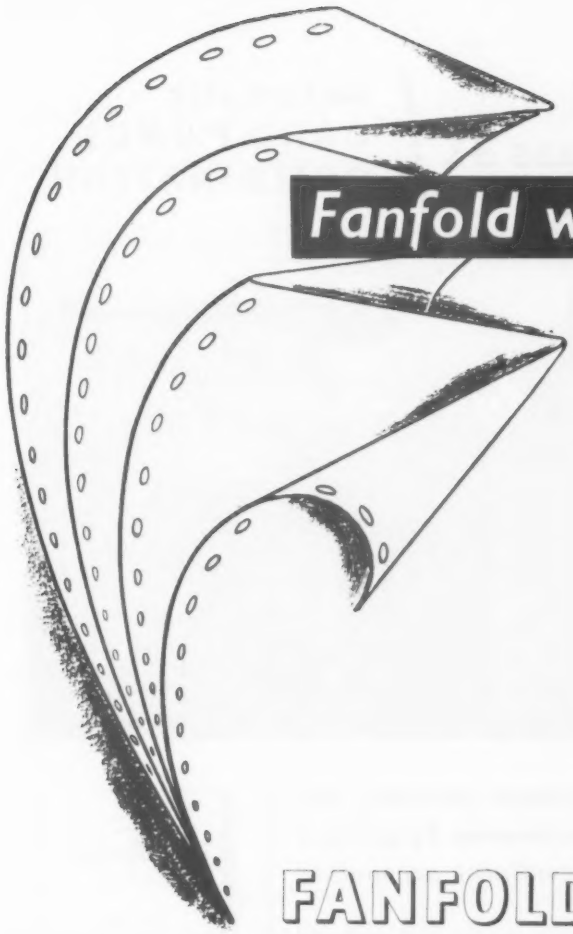

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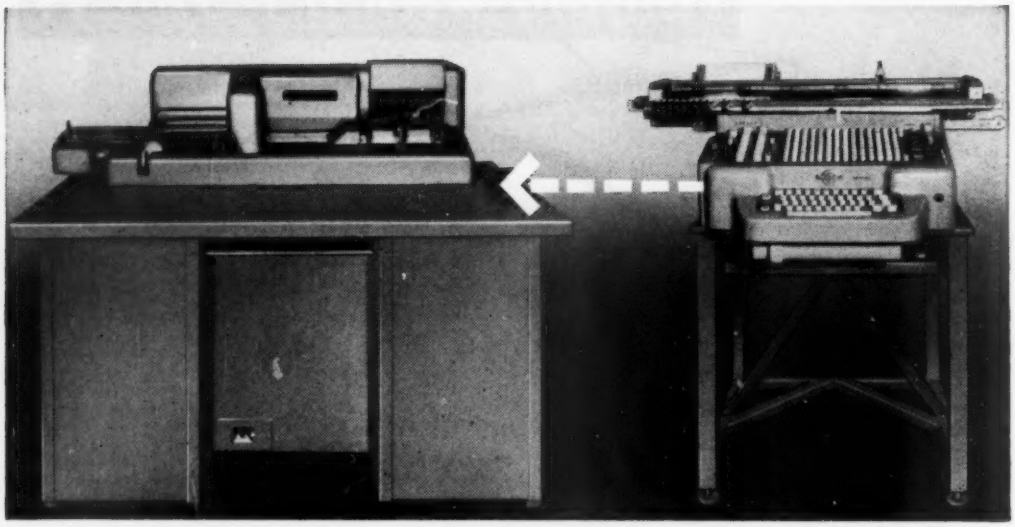

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A monthly survey from the United States prepared by the Research Department of John Diebold and Associates

Automation and the CREDIT MANAGER

For the credit man, automation will mean a change in format and methods, but not a change in the basic information he handles at present

INCREASING use of automatic data processing equipment for accounts receivable is causing a definite change in the credit manager's methods and at the same time seems to be causing a more liberal approach to the principles of credit management. The credit manager's function is essentially one of judgment and, therefore, still remains a 'manual' function in automated systems. But with automation he is freed from much of his routine work and he has a new set of tools made available to him for performing his main functions.

The use of book-keeping machines for keeping accounts receivable records is widespread. Under this system, the credit department has sets of printed ledger cards available which can show all the information it requires for collection purposes, extending credit or answering enquiries. It is this ledger—the visual single source of information—that is eliminated in an automatic system using punched card equipment or magnetic tape data processing equipment.

Punched Card Accounts Receivable Systems

PUNCHED card accounting for accounts receivable is a ledgerless system. Many large companies are using the tabulating equipment; it

is usually true that the accounts receivable application is not the only work being done on the punched card equipment.

Billing is a more common application. However, once billing is applied, much of the accounts receivable work can be prepared as a by-product.

Normally, an accounts receivable record consists of a header card showing name and address, and various other static information, followed by a series of cards, each representing an open item of the account. As remittances are received, they are matched manually and by machine with the appropriate items. These paid item cards are punched with the remittance information and then filed in a file of historical information. At the end of each accounting period, statements can be automatically prepared showing the open items of the account. In other cases, the remittance information may be punched in a separate card and filed along with the invoice item cards. The statement will show the whole of an account's activity during the accounting period. Such a system will often use a summary balance-brought-forward card to be filed as the first open item card for the new accounting period; however, in most cases, in order to have complete information for collecting purposes, the individual open item cards are still carried.

Where Does the Credit Man Get His Information?

USING a ledgerless system means that the credit man does not have a complete historical file located in one place. For collection purposes, he may use copies of the monthly statement. The punched card open item file provides a simple means of preparing aged trial balances.

These may be prepared periodically as an aid to the credit man in collection activities. Ageing of accounts from a ledger card is a time-consuming manual process, therefore automatic preparation of such reports is one of the new system's major improvements from the credit man's point of view. At the same time printed collection notices can be prepared automatically by the system.

Credit history records must be available to the credit department in order for them to approve the extension of credit or to answer enquiries. The basic information involved is:

(1) current status
(2) high credit
(3) manner of payment

In what manner this information is presented to the Credit Department depends a great deal on the particular problems and policies of the company involved.

Current status can be determined from direct reference to the card file. All the open item cards must be added up to obtain a current balance. Such a system may be awkward if the credit department is not located near the punched card installation.

Twice-weekly Activity Report

ONE rather large manufacturing firm finds it useful to print an activity report semi-weekly. This not only shows current status, but, since all past due items carry an asterisk, it is also used in collection follow-up activity.

Another manufacturer uses copies of the regular monthly statements. The credit department keeps close watch on 'credit problem' accounts only. As payment or action on orders are made on these accounts, the credit man marks the statement accordingly, thus keeping it up to date for reference purposes. 'No credit problem' accounts do not require frequent reference, and the company feels the monthly report is sufficient. Clerks, however, do note remittances on the statements of these accounts.

The other two items—high credit and manner of payment—are of particular interest to the credit department, but are not necessary for accounts receivable activity itself. The development of credit history has proved to be probably the most pressing problem for the credit man who is dealing with a punched card accounts receivable system. There are various methods used for making this information available. Many systems use a header card located in the accounts receivable file. Basic credit information such as high credit and manner of payment are recorded visually directly on this card. Often a summary history card file containing the same information is retained in the credit department.

In order to obtain the summary credit information, the credit department usually uses tabulated reports which are prepared from the accounts receivable cards. For instance, a report may be prepared periodically on all paid items by account, thus showing a detailed history of each customer. This type of report will not show balances directly; therefore some computation may be necessary to determine the high credit figure. Nevertheless this type of report in conjunction

with a frequent aged trial balance listing can give a clear picture of the activity on an account.

Information in Monthly Statement

ANOTHER source of detailed historical information can be the monthly statement. If only open item statements are prepared, 'manner of payment' and 'high credit' do not show directly. However, if paid items are retained in the file until the end of the accounting period, the statement can show all activity on an account during the month. Copies of statements can be retained in the credit department, summarized periodically, and recorded on the customer's summary history card. For reference purposes, therefore, the detailed recent history is available in addition to a summary of previous activity.

Generally speaking, the punched card systems provide a much better means of control over credits and collections. Frequent aged trial balances and office copies of open item statements which include more credit information are factors in this improvement.

Problems created by the ledgerless system are evident in the credit history area. For purposes of extending credit, the problem can easily be solved by going to several sources or one of several for the specific information needed.

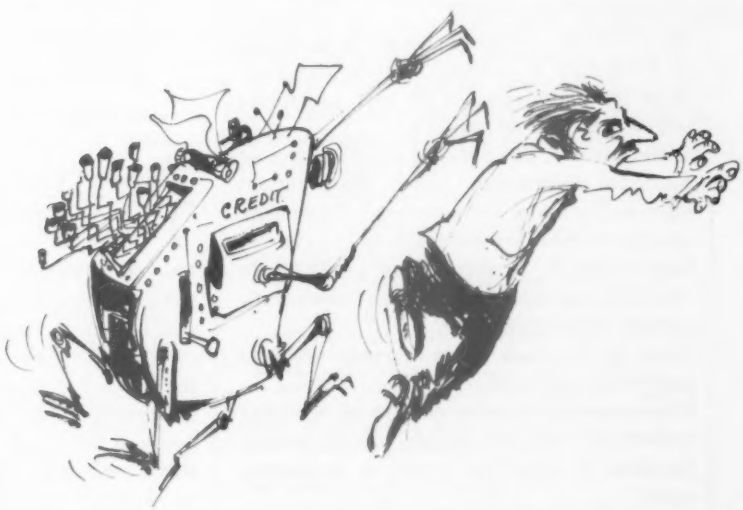
In normal circumstances, most accounts can be assigned credit limits. These can be checked as orders are processed. Accounts may also be flagged for special treatment where necessary. With such culling of orders in normal processing, only items which require credit investigation will be presented to the credit department. Reference to one or more of the tabulated listings or the punched card file itself should be sufficient information for taking action on the order. Thus the credit man is relieved of mere routine checking and can spend his time only on those accounts and matters which are of particular concern.

Answering Credit Enquiries

THE serious area of credit history records concerns enquiries. With the information located in a number of sources, answering enquiries will be more time-consuming than before. As a result, a number of the companies are giving approximate rather than precise information. They are not reporting as promptly as before, and, in some cases, are not answering at all. This certainly may become a problem to the interchanges in the future, yet the problem may be solved by changing the type of information used for a credit rating.

One suggestion was made by the credit manager of a division of Prentice-Hall, Inc in an article for *Credit Executive* magazine, published by the New York Credit and Financial Management Association. His solution required two reports from which sufficient credit information could be gleaned.

These were a record of current status and a record of sales volume by customer, showing gross sales, returns and net sales cumulative from the beginning of the year. Under such a system the credit man could have this information right at his desk for quick reference. The combination of these reports should show how good a customer



'Increasing use of automatic data processing equipment . . . is causing a definite change in the credit manager's methods'
by William Papas

is. For instance the customer with a low current balance outstanding and a high sales volume is obviously a good customer. With regard to reporting to the interchange, 'high credit' and 'manner of payment' are certainly not easily available, but he argues that 'total credit' or net sales, rather than high credit, and current status could do the job just as well. This, of course, would require a change of thinking with regard to releasing sales figures to competitors and also with regard to means of judging credit ratings. Nevertheless, these are the type of changes we can expect with more widespread use of automatic data processing equipment.

Considerations in Planning a System

THERE is a great deal of planning necessary in designing a system for accounts receivable. It is possible to install punched card equipment without causing a great change in the credit department operation; however, when installing a new system it seems logical to examine all aspects of the operation. The credit department can gain from the new system and it would certainly be to its advantage to be active during the planning stages.

The Credit Research Foundation in its report, *Punched Card Accounting and the Credit Department*, lists a few of the questions which the credit executive may want to examine. These suggest the areas where automatic data processing equipment may be used more effectively if changes in information requirements can be made.

MAINTAINING RECORDS

What kind of information is most significant in evaluating a customer's credit standing?

How much information on past experience with a customer is needed?

Is too much reliance placed on experience or historical information rather than current information about the customer? Could time spent in maintaining and referring to customer history records be spent more profitably in obtaining and analyzing financial statements, current ledger experience, etc ?

How up to date must current accounts receivable information be?

How necessary is daily posting of invoices? Would less frequent posting create serious problems in extending credit, or in posting cash?

EXTENDING CREDIT

How thoroughly does an account need to be checked before an incoming order is approved?

Overall, does the time spent in such checking reduce credit risk commensurately?

Could a greater number of accounts be assigned for automatic approval on the basis of normal requirements? Could credit lines be assigned to more accounts in terms of an amount per order rather than total balance outstanding?

Could the concept of 'management by exception ' be more extensively applied?

Without undue risk, could some of the decisions now made by credit men above the clerical level be made a part of clerical routine, freeing the credit men for more demanding work, such as statement analysis, study of complicated risks, or closer contact with the sales department?

COLLECTING PAST DUE ACCOUNTS

To what extent can collection procedure be made a matter of routine, through the use of printed notices, form letters, etc?

To what extent, and at what point, must a past due account receive personalized attention?

How soon after an invoice matures must collection action be initiated?

What is the most effective interval between follow-up notices?

ANSWERING CREDIT ENQUIRIES

Are exact figures necessary in reports, or can approximations within a specified range serve just as well?

Which kinds of reports or information are most useful?

Magnetic Tape Systems

THE step from the use of punched card to magnetic tape equipment for accounts receivable presents some new problems and solves some of the old. Considerably more information can be stored in a tape file than in cards. The computer can also make more extensive checks, tests and computations than the punched card equipment. An integrated order processing-accounts receivable tape system can automatically check credit limit, determine past due balances or recognize special treatment codes. Those orders

which do not pass the automatic credit checks and, therefore, must be referred to the credit department can be sent to the credit department in the form of a special print-out of the current status of the account with credit history as well. This means the credit man will have complete current information and a summary of history on the account.

For accounts receivable purposes, the active records are similar to a punched card record. Basic information such as name and address, credit rating, and summary history information is stored. All open items are carried in the current file. As payments are received they are applied to the appropriate invoice file. The open item with its payment information is transferred to a history tape, thus keeping the current file at a minimum. At the same time a tape is built up for print-out of historical information.

Problem of Payments 'On Account'

THE application of cash is no problem if customers make their payments on particular invoices, but payments on account which do not identify or wipe out a particular invoice can be a problem in an open item record system. In most cases it is necessary for cash to be processed manually against open item statements to determine the invoice which is being paid. Where the applicable invoice cannot be immediately determined, the credit item must still be applied to the account, but carried as a credit in the open item record. The account balance will of course reflect this credit, but no particular invoice will be paid by it. Situations such as these require continuous adjustments and can be a problem with regard to the accounts receivable application. Most companies will still require a considerable amount of manual clerical operations along with the automatic system. This is a greater problem in tape systems than in punched card, because all adjustments must be introduced through the computer in a standard format.

While the tape file can carry more complete information for producing the credit man's requirements in terms of printed reports, the system is certainly more rigid than the punched card and particularly the ledger system. Records are stored on magnetic tapes sequentially and any transactions—debits, credits, adjustments or enquiries must be processed as the tape file is run. This means that the credit man does not have access to the accounts receivable records. He must use the reports that are prepared for him and any enquiries which must be answered from the file must be submitted before the daily processing run or else wait until the next day.

Credit Manager's Reports

AS far as the credit man's reports are concerned, the magnetic tape systems are usually able to produce the reports faster and consequently more frequently if necessary. Even special accounts can be selected for more frequent reporting where required. Each company will have its own requirements. Normally monthly reports showing all activity on each account are prepared. These provide the manner of payment records very similar to the old ledger cards. The high credit figure for each account can be carried in the tape record because the computer is able to keep track of this figure automatically. This may be shown on the historical report. For current status, many companies will print out a transaction report daily, showing all activity which was processed that day. At certain scheduled times, an aged trial balance can be run off on all accounts for collection purposes or copies of monthly statements themselves can be used for this purpose.

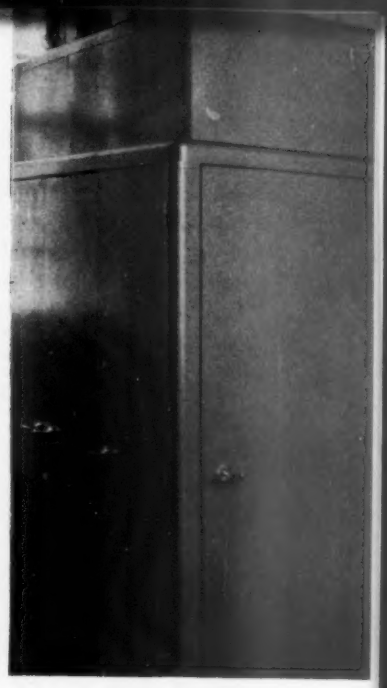
The magnetic tape systems as well as the punched card systems have deprived the credit man of his ledger card, but efficiency of an accounts receivable system integrated with other computer applications such as billing and inventory control, will in most cases overshadow the inconveniences placed on the credit man. It is still possible to provide the credit department with its requirements. At the same time the credit man is relieved of the routine credit checking. The credit departments are faced with a change in format and methods rather than a change in the basic information itself.

CONTRIBUTIONS

The editor invites authoritative and thoughtful contributions on all aspects of automatic data processing. Factual accounts of first-hand experience in planning, installing and operating computer systems are particularly invited; but theories and prognestications based on practical experience in commerce, industry and government are also welcome.

Articles, preferably between 2,000 and 3,000 words in length, are most acceptable when typed with double spaced lines on plain quarto paper. They should be addressed to:

The Editor
AUTOMATIC DATA PROCESSING
Mercury House, 109-119 Waterloo Road, London, SE1



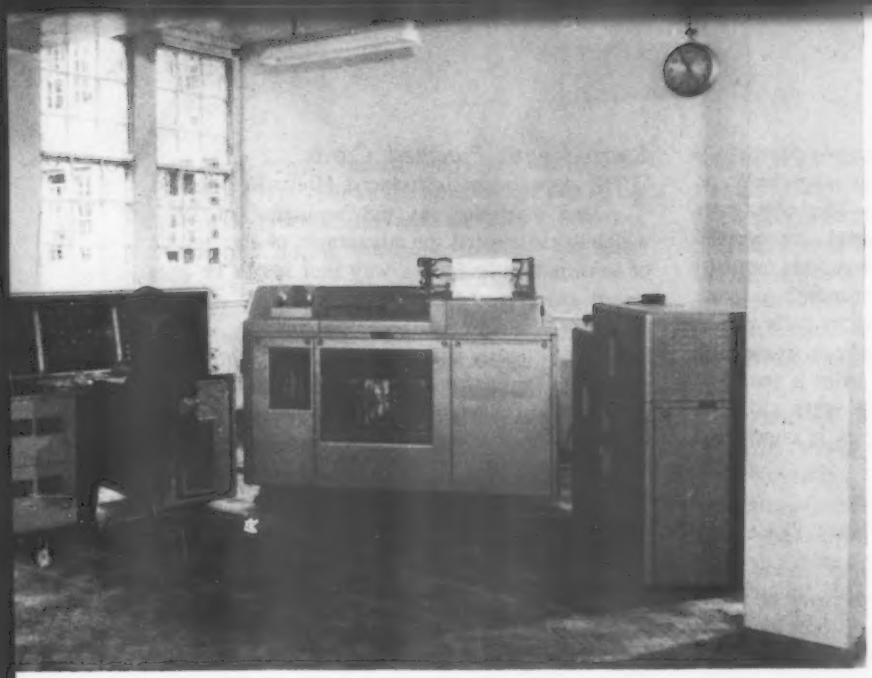
The Post Office's supply department, which has to keep track of several thousand stock movements daily, majored from a punched card system to a computer system to get faster results and keep better tabs.

Effective Stores Control in the

THE initial job for the Post Office's new National-Elliott 405 computer, which began operation in June, is the payroll of 112,000 London workers. The size of the task justifies a big computer for this first, comparatively elementary use, despite the tendency of some pundits to pass over payroll usage as offering only clerical economy and no managerial benefits. Payroll, in fact, offers a number of advantages as a starting job for a new computer since it is well understood in the counting house where wage and salary data are processed and its results in the pay envelopes are carefully and individually checked by those who receive them—factors which can build all-round trust in the new machine within a short time and so lead to its wider employment in other work.

Such confidence-building is already well advanced in wide sections of the Post Office. Besides operating a Hec 1201 in its supplies department since August 1958, the great experience of the Post Office with electronic apparatus early led it into computing and its engineers designed a general purpose machine, MOSAIC, which was installed in 1952 at the Ministry of Supply for trials analyses.

Its engineers, in association with Powers-Samas, also pioneered the equipment (now installed in Canterbury, Edinburgh and Birmingham and soon to cover the whole country) in which photo-electric



Most of the Post Office's practical experience of using computers stems from the jobs that have been put on a Hec 1201 machine which was installed in 1958.

by KEITH BEAN

POST OFFICE

mark-scanners, electronic amplifiers and multiplying punches can deal with all ticketed calls and give the whole telephone account. A recent development in this equipment is the successful use of pencil marks to be read as punched cards.

Supplies Department Installation

BUT, to date, the supplies department's Hec 1201 is probably the most interesting Post Office installation in the general sense, since its efficiency requires the application of principles basic to stores planning of all sorts. It is a big operation, providing the tools for the job to some 350,000 people whom the Post Office employs.

'We need about 70,000 items of stores to develop and maintain the postal and telecommunications services of the country,' says Mr. H H Simmons, Assistant Controller of the supplies department, 'and one of our biggest problems—a problem common to most stores organisations—is to maintain adequate but not excessive stocks in proper balance. To accomplish this efficiently demands an up-to-date knowledge of the state of stocks, nationally, with facilities to make frequent reviews to permit corrective action when and where necessary.

'In other words, if we are to avoid loss of revenue through non-availability of stocks and avoid the unnecessary tying up of capital in excess stocks, there must be sound stores control. The

achievement of this apparently simple objective is made complex and difficult by its magnitude and the number of factors involved. The stores vary widely in size, shape and material, are derived from a variety of sources, and the periods required for their procurement vary from a month to many months. Some items are subject to daily movements or even many movements in a single day. Other items move only once or twice a year and still others only once in several years although their retention against emergencies is considered necessary.

Stores in many Locations

'BESIDES being held in one or more main storage depots the great majority of items are held in and issued from many stores locations in the field, spread throughout the United Kingdom.

'Thus throughout our whole stores structure there are several thousand stock movements each day, all of which affect the state of the national stocks both in quantity and value. If these movements are not properly controlled they must result in money not being spent to the best advantage and unbalanced stocks—too much of some things and not enough or none at all of others.'

The work of the Post Office divides, broadly, into two parts—postal and telecommunications. The great bulk of the money for stores is spent on telecommunications items and therefore it is toward better control of telecommunications stores that the department is directing its modern data processing methods initially.

A Lot of Money

'THERE is a lot of money in it,' Mr. Simmons said. 'Interest charges on excess stocks mount up and, of course, capital is locked up in them which could be more productively used. Quite clearly, too, loss of revenue can occur because of non-availability of stores. And loss of output through having to switch labour from job to job because of stores shortages can be very considerable. We have recognised for many years that to achieve adequate but not excessive balanced stock holdings, speedy and integrated data and figures giving a complete, accurate and up-to-date picture of the national stores position, "hot" information and figures and the means of handling them while they are still "hot," are essential.'

Started with Punched Cards

THE department introduced Hollerith punched card machinery at the beginning of 1954, which demonstrated the advantages of the storage of information in such a way that it can be processed more speedily and without the clerical drudgery which contributes largely to delays, ineffective figures and data. Requisitions for stores by engineers are immediately translated into punched cards and from these Detail Cards flow the following documents:

1. Selection (or Issue) Slip.
2. Packing Note.
3. Priced Delivery Note (or Invoice).
4. Ledger Statement.
5. Demand and Issue Rate of a range of High-Value Items.
6. Provision Position Statement.

'This was very satisfactory up to the ledger statement but, from consideration of the full development to the stage where we could get from the punched card system necessary analyses and statistics in a form suitable and ready for executive judgment, it became clear that long and complicated procedures would need to be devised, and more staff and more quite expensive machines would be needed,' said Mr. Simmons.

'Moreover it was quite apparent that at the end of the month, quarter or financial year there would be a considerable upsurge of work in the punched card unit and, as the various analyses and returns were all wanted "immediately" and we could only move from process to process or step by step, someone would be kept waiting. Despite the considerable advantages of punched card methods, we should fall a good deal short of the ideal.

Data Too Slow

'THE "operator interference" involved in the movement of large numbers of cards from one machine to another and the need for the most careful daily planning and control of operations to ensure that the final output was not delayed by failure to complete the prior sorting, collating and calculating operations tended to produce necessary data too slowly for our full needs.

'This led to a study of the possibility of integrating some of these processes and the elimination of "operator interference" and it was not a very long step from there to serious thoughts on the employment of a general-purpose

digital computer. Indeed, we regard the installation of the Hec 1201 as the next logical step in the development of punched card methods rather than a new and daring excursion into the computer field.

'First, I put myself on a computer appreciation course in November 1956. This convinced me of the need to get computers into proper perspective because at that time a great deal of nonsense was still being talked about electronic brains. To this end, two weekend courses were arranged with the Hollerith Company, each attended by about 30 senior officers of the department—depot managers, heads of sections and so on. They were in April and November 1957.'

Getting the Right Perspective

'We wanted these senior people to get computers in the right perspective, with a slight bias toward de-bunking them somewhat, so that they would go back, talk to those under their control and spread the gospel that these wonder machines could, after all, be handled by quite ordinary people. This object was most successfully achieved.

'By the time the computer was installed the whole staff of the department had a pretty general idea that what had arrived was a new aid to our work and not some invention of the devil which was to master our activities.

'By November 1957 we had selected six men to take a programmers' course. We selected them because they were under 40 (most of them well under 40) and they had, so far as our knowledge went, logical minds, imagination, drive, diligence, a capacity for patient investigation and a sound knowledge of the field of work to be programmed for the computer. We did not subject them to psychological or aptitude tests and we did not seek potential programmers with honours degrees and that sort of thing. They were, if you like, bright young men of our staff who appeared to us to have the necessary aptitude.

'They all did very well on the course and immediately got down to their considerable task and made progress with which we are very satisfied indeed. In selecting men to be trained as programmers who were well experienced in the field of work to be covered we are sure we were absolutely right and convinced that it is better to teach programming to a man well experienced in the functions of the organisation rather than to try to teach a trained programmer the functions of the organisation.'

That contention seems to be well borne out by the case history of this installation.

Programmes Tested—and Operated

THESE men took the programming course in November 1957 and two complex programmes—one of 900 steps and another of 700 steps—had been written and proved on a Hec 1201 and were available for customer's test at the factory by June 1958. The computer was delivered on July 17, handed over by the engineers on August 5 and operational work—not experimental work but operational work—was coming off the computer at the end of August.

Explaining the choice of a Hec 1201, Mr Simmons pointed to the department's experience with Hollerith punched cards and added: 'We had no computer experience and the price of the Hec seemed a reasonable figure to pay to acquire it, especially as it seemed reasonably clear that it would do the job for which it was being acquired. Delivery prospects were reasonable. We still think we were right.

'Installation and take-over went very smoothly. Out-of-service periods have been few and lower than we had anticipated. Such as have occurred have been of short duration. Facilities have been given to the Department of Agriculture for Scotland for a long and complex analysis of farms and small holdings and this with our own work and programme testing for new projects have kept the computer working for an average of six hours each working day so far. For about two months during the year-end stock valuation we use the computer for eight to ten hours a day five days a week. With a list of 44 tasks lined up for the next three years, we will be making more and more use of it. And we are getting our information much faster. The quarterly review used to give us our information in three months, which meant that it was always three months old. Now we get it in 28 days.'

Names and Notes

A computer, centralising 40,000 Barclays Bank current accounts, will put a

BRAKE ON COSTS

FOUR organisations—Barclays Bank, the Air Ministry, the Ministry of Labour and National Service and Kodak Ltd.—recently added their names to the order book for Emidec 1100 computers.

▸ Barclays are the first of the London clearing banks to order a computer, and their machine will be delivered in mid-1961.

It will be used to undertake centralised book-keeping for 40,000 current accounts for a group of branches in London's West End. The proposed system of operation, by making use of information transmitted by teleprinters (and by dispensing with cheques and other vouchers in the building where the processing will be carried out), is reckoned to be the first of its kind in any bank in the world.

The computer should make it possible for each branch to handle more accounts, and at the same time the bank are confident that their machine will produce economies to check the trend toward rising costs—and the increased bank charges that would inevitably follow.

Barclays' computer will cost £125,000.

▸ The Air Ministry's Emidec 1100 will cost £190,000 and is destined to handle the payroll calculations of some 80,000 civilians working at headquarters, and at airfields and establishments throughout Britain.

The calculations involved have to be made in accordance with an extremely complex code of regulations, and the computer will enable this work to be done more efficiently and economically than ever before.

The system will automatically prepare pay sheets, coin and note lists for cash wages, cheques and bank transfer slips for staff paid monthly, and pay slips for all civilians.

A central pay office, where pay and personnel records will be kept, is being established near Manchester, and the computer will form the nerve centre of this new set-up. At short notice it will also be possible to provide detailed statistics of costs, and of numbers employed throughout the country—either in grades and locations, or down to an individual's personal service record.

The computer is scheduled to be delivered at the end of 1960.

▸ Initially the Ministry of Labour and National Service's computer will be largely employed in calculating statistics relating to employment, wages, hours of work, and the Retail Prices' Index. Also it will be used to prepare the payroll for the Ministry's 20,000 employees.

The system is to cost £140,000 and is also due to be delivered at the end of next year.

▸ Kodak's computer will form the nucleus of a data processing centre to take care of the company's accounting and stock recording.

From each of Kodak's nine United Kingdom branches, information regarding deliveries of goods to customers will be sent to the data processing centre in the form of punched paper tape.

The computer will prepare invoices and maintain personal and statistical accounts for some 30,000 customers. It will also produce a variety of sales analyses and will keep complete stock records for each branch so that stock replenishments can be automatically requisitioned.

Kodak Ltd also intended to develop production

planning techniques for their factories on the Emidec.

APPROXIMATELY £625,000 is the sum that the Royal Army Ordnance Corps will have to pay out for a recently ordered Emidec 2400 data processing system and for work connected with putting it on stream.

Main task for the machine, which is expected to be delivered in June 1961, will be to maintain full records of the Army's stocks of motor transport spares, to compile accounts for stores and to calculate the requirements for re-stocking.

More Simulation on the Way

PINPOINTING the increasing interest in automatic control in petroleum processing is the order for an electronic analogue computer-cum-process simulator that British Petroleum have lodged with the Aylesbury firm, Air Trainers Link.

The machine, named inevitably after its initials (CERES for Control Engineering Research Electronic Calculator), will be built to specifications laid down by BP's refineries and technical department and put to work at Longbrow House, London. Destined to simulate conditions in various fields of refining operations, it will permit study and development of the most suitable automatic control systems and efficient plant designs. Also it will be used to probe into such problems as those relating to plant economics, and stress and vibration analysis.

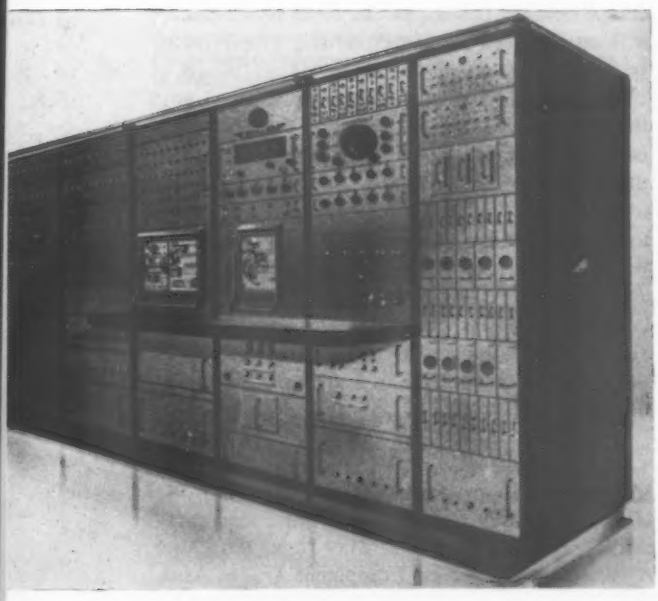
Set up as a simulator, Ceres will be used to reproduce typical or exceptional situations in controlled refining processes. Thereby plant operators may be trained to deal with a range of conditions which would be impracticable to arrange at a refinery.

Additionally, new processes may be demonstrated before a plant has been completed.

BP's machine will comprise 48 DC amplifiers and 92 coefficient potentiometers. Two servo-multipliers are provided: one with a very fast response, and the other, though much slower, is suitable for long term integration. Both types will generate non-linear functions, if required.

Two patch panels are provided with removable plug boards to give 'pre-patching' facilities.

An artist's impression of the analogue computer-cum-simulator ordered by British Petroleum



Recipes on Punched Cards

CARR'S of Carlisle have embarked on an extensive modernisation programme of their biscuit factory. For some time past most of the ingredients have been brought into their factory in bulk and the present programme involves the installation of a bulk flour plant and the automatic distribution, weighing and delivery of all ingredients required for a variety of biscuit types direct to the mixers.

Carr's have called in two firms—well known in their respective fields—to design and supply the equipment for delivering and controlling the flour. The contract for the first stage of the project has been given to Thomas Robinson & Son Ltd of Rochdale, flour milling and conveying engineers, who are working in collaboration with Elliott Brothers (London) Ltd in devising an automatic control system. Flour will be brought to the factory in bulk vehicles and will be conveyed pneumatically throughout the storage processing and weighing operations by the Robinson's Pneu-Flow pressure conveying system.

The installation, due to be completed later this year, is part of a comprehensive plan for re-equipping Carr's biscuit factory to the latest techniques in automation.

In the plant now ordered the recipe cards for biscuits will be in the form of specially designed punched cards. There are dozens of these cards,

each one corresponding to one of the dozens of different recipes from which Carr's biscuits are made. Those required for the day's make of biscuits will be inserted in the control panel. The recipes will be selected, according to demand, by an electronic searcher and stored in the memory of the control panel. The appropriate quantities of different grades of ingredients will then be selected automatically and delivered to each mixer.

The distribution and metering of fat, syrup and glucose are to be done with equipment specially developed for the purpose by Carr's engineering department.

Cine Story

ONCE upon a time it was said, by the people who publish books, that television would kill them, or, as they say elsewhere, TV would ruin the publishers. Why? Nobody would read books.

They said the same thing when the cinema came along, and they are selling more books than ever. Came TV with a rush, and the movie-makers quaked. Nobody would see them, they said. So it happens that the dying film industry dies like an opera soprano. Takes a long time and makes a lusty business of it.

The fact is that the industry, pronounced dead regularly during the past 10 or 15 years, is now employing more people than did all the major studios in their lushest years.

Take one example. Talk to William Cresant, comptroller of a very successful enterprise owned by a well-known Cuban, Desiderio Arnaz, and his wife, better known as Lucille Ball.

The movie business has become so big and so complex that not even the usual accounting machines can keep track of it. Desilu Productions alone is turning out what amounts to some 200 major feature films a year. Many are series of half an hour or an hour each. But, says Cresant, compare this with about 30 features produced annually by most major studios, then add that in 1959 Desilu may film more footage than all the majors combined.

'That's a lot of footage, and it translates into people, props, painters, producers, etc. — and money. It also means the financial experts behind the scenes, and it even goes beyond that, for the experts had to get some pretty specialised help of their own, help that comes rather high in cost but is more than worth it: Remington Rand's Univac computer.'

And remember the vanishing horse that went with the vanishing Indian? Desilu has more horses than actors on the payroll. It is a fact that some horses earn 100 dollars a day, but in addition to their salary there is a 233-dollar item for clean-up. Every item, every bit of expense, must be accounted for. That's why the new wizards of Hollywood called on their colleague, the Univac computer.

Open Days at BISRA

THE British Iron and Steel Research Association will throw open their laboratories at Battersea Park Road, London, to industrialists and others interested in the engineering and technical problems which concern the iron and steel industry.

Its operational research department, besides illustrating the work of the computer applications section, proposes to highlight the work of an 'operational investigation' section which has done considerable work for the association's members.

The 'open days' will be Thursday and Friday, October 22 and 23.

A Card Check on Visitors

AT the recent British Trade Fair in Lisbon, complimentary tickets, in the form of 40-column ICT cards, were issued beforehand to exhibitors. In all, ICT prepared 20,000 cards on behalf of 131 exhibitors, and each card was punched with the exhibitor's fair number. Of the 20,000 issued, 9,200 were returned later to ICT. After they had been mechanically counted, lists of the totals and of the exhibitors' names were passed to British Overseas Fairs Ltd. Each exhibitor was thus informed of the number of visitors who attended the Fair with complimentary tickets issued by him.

The computer company have provided similar tickets at three British fairs overseas — Copenhagen, Helsinki and Lisbon.

Repeat Performance

HARD on the heels of a successful office machinery exhibition at Olympia last May-June, the Office Appliance and Business Equipment Trades Asso-

ciation now moves to Northern Ireland. King's Hall, Belfast, will be the venue of this latest venture, with an exhibition opening on October 12 and lasting a week.

Administration Taken Over

BILLED to take over 'the entire administration operation' is the IBM 705 computer which was recently installed in the headquarters of the French bank, Le Crédit Industriel et Commercial.

A deposit bank, the CIC has 1,200 branches in France and reckons to coffer in deposits over 300,000 million francs.

Competition for Executives?

IN a moment of mental aberration Mr J Goldsmith, speaking to the British Computer Society's conference held in Cambridge recently, said that it would 'take five to ten years before computers controlled management.' He meant, of course, something quite different, and corrected himself immediately; but a recent report in the *Daily Telegraph* quoting remarks made by Dr Arthur Samuel, a scientist working on learning machines with IBM in the States, suggests that unconsciously Mr Goldsmith's remark might have a grain of truth.

For Dr Samuel was quoted to have said: 'If good machine learning techniques can be developed, much work such as running a business, might be taken over by computers. But it would take 20 to 50 years to achieve this.'

Bull in America

PREPARING to market its Gamma 60 computer in the United States next year, the French Compagnie des Machines Bull is currently negotiating with US firms to this end, reports the American weekly *Electronic News*. It is not yet clear whether the company will license production and distribution or establish a subsidiary, part- or wholly-owned, but as a prelude to marketing Bull have terminated an agreement with the Sperry Rand Corporation (Remington) which involved sub-contract work for the American firm and exchange of patent information.

Books Reviewed

W Oppelt (editor):
Anwendung von Rechenmaschinen bei der Berechung von Regelvorgängen
R Oldenbourg. Munich. 128 pp. DM 16.80.

H Zemanek:
Elementare Informationtheorie
R Oldenbourg. Munich. 120 pp. DM 14.20.

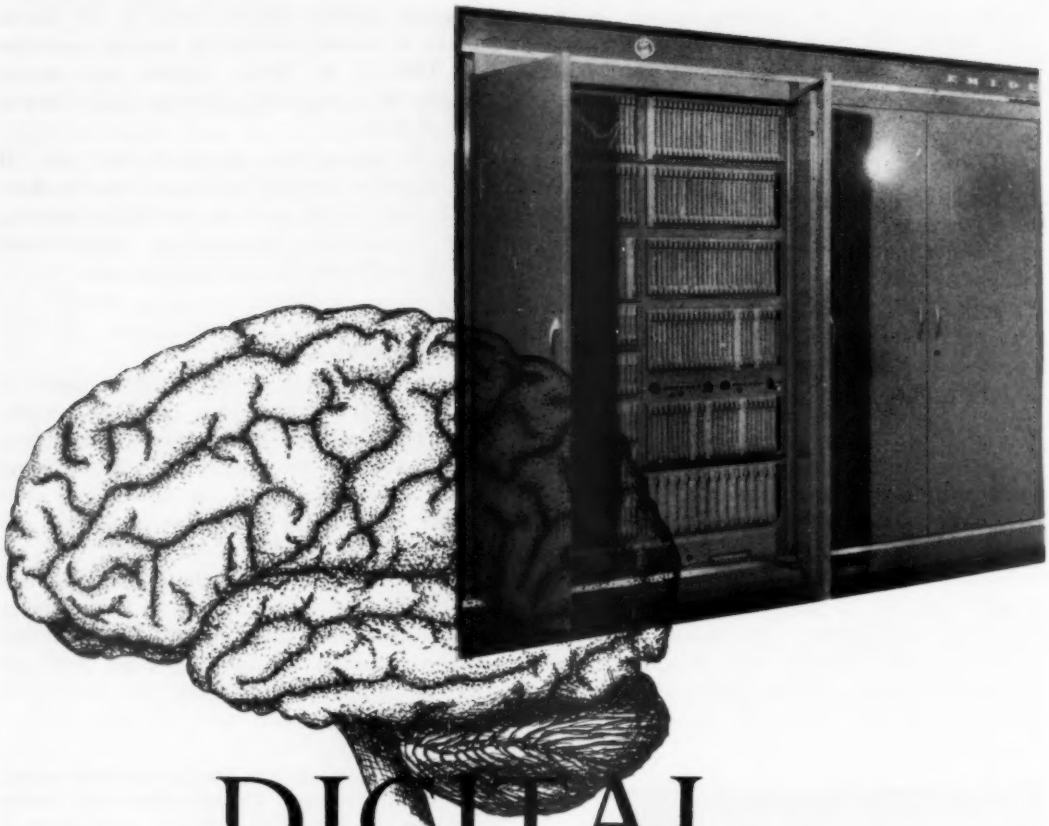
J. Heinhold (editor):
Fachbegriffe der Programmierungstechnik
R Oldenbourg. Munich. 18 pp. DM 4.40.

THE COLLECTION of essays, edited by Oppelt, are the written results of a conference held in Düsseldorf in 1957. They form a rather disconnected whole which discusses various aspects of analogue and digital computation applied to the theory of control. The first paper, by E Bucovics, describes various types of computer ranging from the Telefunken RA463/2 analogue computer, to the IBM 705 large-scale data processing machine and the IBM 604. There is a very brief account of programming and some remarks on stability criteria in control. The second paper, in English, is by J B Reswick and describes a graphical technique for determining the transient response of a system from its performance under test. The third paper, by A Leonhard, discusses the analogue computation of polynomials. The remaining seven papers discuss various aspects of analogue computation in theory and practice and are particularly directed to the investigation of control system stability. Individually the papers are excellent; together, however, they are insufficiently connected to be attractive to any but specialists.

Zemanek's book is an excellent introduction to Information Theory. The approach, via logical nets to the statistical theory of information, is refreshing and illustrated by numerous practical examples. Much interesting material on the efficiency of codes and the design of self-checking and correcting systems appears in the text and some work by Shannon on random associations of letters with increasing context is shown to be just as applicable to the German language as to the original English. For those who read German the book can be unreservedly commended, for those who do not, it is to be hoped that an English translation soon appears.

Almost as an aid to reading the previous books the little multilingual glossary by Heinhold contains the equivalents in English, French, Swedish, Dutch and Russian of various German words in the field of digital computer programming. There is also a brief technical explanation (in German) of the more obscure words. This is well produced and, because it contains an index in each of the 'foreign' languages as well as in German, will be very useful to all who have to read German papers in this field.

A D BOOTH



DIGITAL COMPUTERS

A Simple Introduction to the Brain

by ERROLL WILMOT

'. . . an approach toward the understanding of the nervous system from the mathematician's point of view' was the last contribution to knowledge of the late John von Neuman. His incomplete manuscript was published recently by the Yale University Press

The drawing of the brain is taken from Anatomical Atlas *by Maud Jepson, published by John Murray, by whose kind permission it is reproduced.*

JOHN VON NEUMANN was professor of mathematics at Princeton Institute for Advanced Study when, in 1955, he was invited by Yale University to deliver the Silliman lectures during the following year. This invitation is a much-coveted honour among mathematicians and scientists, and there is no doubt that von Neumann felt honoured by it; but he had to make a reservation, when accepting it, that he should deliver the lectures during a week instead of the customary fortnight, as he had just been appointed by President Eisenhower to the Atomic Energy Commission. He and his wife moved from Princeton to Washington where his new appointment required him to be, and he began work on the lectures in the little spare time that his official duties allowed him. He chose as the subject of his Silliman lectures, *The Computer and the Brain.**

An Incomplete Manuscript

IN fact, von Neumann was never able to deliver the lectures or even to finish the manuscript from which this book was published. In August of 1955 he was found to be suffering from bone cancer, and by January 1956 the illness had advanced to such an extent that he was confined to a wheelchair. He was still working at the manuscript of the lectures when, in April 1956, he entered the Walter Reed hospital; but he was unable to finish it before his death on February 8 1957.

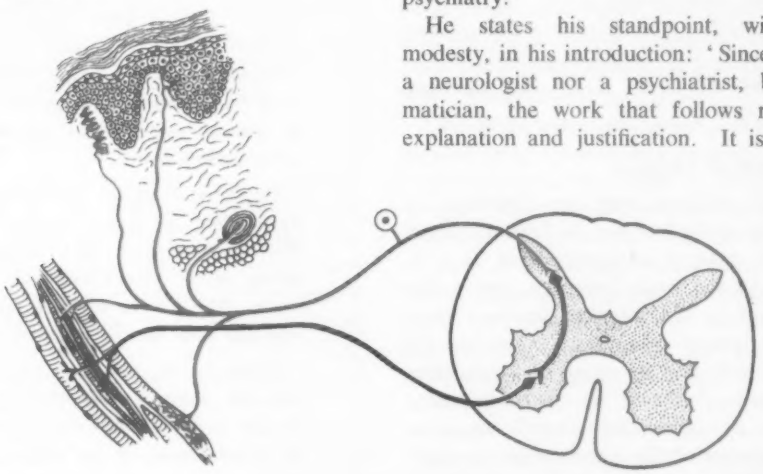
These facts are related by his widow, Klara von Neumann, in a preface to the book that was subsequently published by Yale University Press. She relates the main events in his life and traces the growth of his interest in automation as an aid to mathematical calculations. He was born in Budapest in 1903 and studied at Berlin University, Zurich Technical College and Budapest University. He held teaching appointments at Berlin University and Hamburg University, and in 1930 he was invited to spend a year as a guest lecturer at Princeton University. He was persuaded to stay at Princeton, and he became an American citizen. At about this time his interest became focused upon the great difficulties of obtaining solutions to partial differential equations by known analytical methods.

Mathematical-Logical Design of Computers

IN the late thirties he was engaged on defence work for the United States Army's Ballistic Research Laboratories, where he made use of the Emiac computer while working on the interaction of shock waves. He helped to modify the mathematical-logical design of this machine and, after the war, in working on the design of the Joniac computer, he tried to imitate in it some of the operations of the live brain. For this purpose he made a study of neurology and psychiatry.

He states his standpoint, with attractive modesty, in his introduction: 'Since I am neither a neurologist nor a psychiatrist, but a mathematician, the work that follows requires some explanation and justification. It is an approach

* *John von Neumann: The Computer and the Brain. Yale University Press. London: Oxford University Press. Pp. xiv and 82. 24s.*



Diagrammatic representation of the neurones in a reflex arc. The receptor neurone is shown in red. Reproduced, by permission, from *Gray's Anatomy*, 32nd edition, published by Longmans, Green and Co Ltd.

toward the understanding of the nervous system from the mathematician's point of view.'

He continues with two important reservations: that he is offering no more than a 'somewhat systematised set of speculations,' and that the 'mathematician's point of view,' as he would like to have it understood, 'carries a distribution of emphases that differ from the usual one: apart from the stress on the general mathematical techniques, the logical and statistical aspects will be in the foreground.'

Basic Principles

THOUGH the practical utility of the book may not be immediately apparent, and though much that it contains is difficult for the non-mathematician to understand, few people who have any interest in computers or in the theory of information processing will regret spending some time and trouble in trying to understand it. The first part describes the principles on which computers, both analogue and digital, operate.

In an analogue computer, each number is represented by some suitable physical quantity, such as the strength of an electrical current or the degree of rotation of a disc. In the digital procedure each number is represented as a sequence of decimal digits, and each decimal digit is represented by a system of binary digits. The analogue computer still has certain advantages over the digital computer in many kinds of industrial use. The digital computer, on the other hand, is able to operate with a very much higher degree of precision. The relative accuracy may be expressed as $1 : 10^{12}$ in the case of the digital machines compared with $1:10^{5}$ in analogue machines.

Logical Control Organs

THE digital machine may be visualised as consisting of a number of logical control organs. Each control sequence point is connected to one of the basic operation organs that it actuates, and to the memory registers from which it will derive information, and to the register that will receive the result of the calculation. After each calculation the control sequence point actuates its succeeding control sequence point. A refinement of this is the system in which the control sequence points are replaced by orders —numbers—which indicate which basic operations are to be performed, from which store addresses the data are to come, and to which output addresses they are to go. In this system each order determines its successor.

'The machine, under the control of its orders, can extract numbers from the memory, process them and return them to the memory; i.e., it can change the contents of the memory—this is its normal *modus operandi*—hence it can change the orders that control its actions. Thus all sorts of sophisticated order-systems become possible, which keep successively modifying themselves and hence also the computational processes that are likewise under their control.'

Similarity to the Brain —and Differences

AFTER reviewing the working characteristics of the computer, the nature and functions of its active organs, the various arrangements of

JOHN VON NEUMANN used his knowledge of the logical and mathematical techniques employed in computers to speculate about the intricacies of the human brain; and, reciprocally, he sought knowledge of man's neural mechanism to advance the design of electronic computers.

Last year, another researcher into the working of the human brain, Dr Arthur Jensen of New York Medical College, announced that he wanted to get, for comparative study, a whale's brain, which is said to resemble the human brain, in its general structure, as closely as do some simian brains.

Dr David Hummel, a Swedish doctor who sailed as ship's surgeon with a Norwegian whaling fleet, obtained two brains of fin whales and one of a sei whale, which were sent to Dr Jensen, who has now started research on them.

Admirers of Herman Melville will probably share a hope that the whale should, however indirectly, contribute to the development of computers and, no doubt, to electronic marvels which at present are only dreams or hopes.

memory stores, typical access times, etc, von Neumann turns to a comparative consideration of the brain.

'Bringing out the elements of similarity leads over well-known territory. There are elements of dissimilarity, too, not only in rather obvious respects of size and speed but also in certain much deeper-lying areas: these involve the principles of functioning and control, of over-all organisation, etc. My primary aim is to develop some of these.' He then remarks that 'the most immediate observation regarding the nervous system is that its functioning is *prima facie* digital.'

The Nature of Nerve Impulses

THE basic component of the nervous system is the nerve cell, whose normal function is to generate and propagate a nerve impulse, electrical, chemical and mechanical in nature, along the branches, or axons, of the nerve cell. The electrical disturbance is usually about 50 millivolts, lasting about one millisecond. Chemical changes in the intracellular fluid occur simultaneously with electrical-chemical changes in the membrane of the axon. The nerve cell and axon resume their original condition when the impulse has passed. The stimulation of a neuron is usually due to other nerve impulses and is conditional on the combination and synchronisation of stimuli.

'The nervous pulses can clearly be viewed as (two-valued) markers . . . the absence of a pulse then represents one value (say, the binary digit 0), and the presence of one represents the other (say, the binary digit 1).' The combinations and synchronisms necessary to activate a neuron can then be regarded as programme elements.

Comparative Efficiency

FROM the point of view of the comparative efficiency of the electronic computer and the brain, size and speed are obviously important. At the time that von Neumann wrote, the man-made computer was, he estimated, between 10,000 and 100,000 times as fast as the human brain. The basis of the comparison is the time taken for the neuron or its corresponding machine component to recover from one impulse in order to be fully ready to accept another. On the other hand, the brain is about 100 million times as compact.

Such direct comparisons are, however, misleading in that they involve a very great over-simplification of the factors involved. For example, the nerve impulse-response pattern may be considered as a simple, logical *and-or* mechanism; but this is 'a simplification and idealisation of reality.' Furthermore, though neurons have been considered as making response to simple stimuli along single axons, the response may in fact be governed by complex relationships and synchronisms of impulses from many axons.

The picture is still further complicated by the consideration of neurons as receptors of external stimuli, such as sound, light, heat and pressure; and 'all complications of this type mean that a nerve cell is more than a single basic active organ.'

The Language of the Brain

THIS review has indicated only very briefly and incompletely the many aspects of a fascinating problem that was occupying von Neumann's mind in the last months of his life. As he was unable to finish the manuscript, still less, presumably, to revise it, one ought not, perhaps, to speak of his 'conclusions.' Indeed, in this field, as in so much that we understand by the term 'science,' it is rarely that we regard any knowledge as conclusive. Rather, speculation leads on to speculation; and in this regard, the final paragraph of von Neumann's book, in which he is discussing the language of the brain, is of outstanding interest.

'When we talk mathematics,' he says, 'we may be discussing a *secondary* language, built on the *primary* language truly used by the central nervous system. Thus the outward forms of our mathematics are not absolutely relevant from the point of view of evaluating what the mathematical or logical language truly used by the central nervous system is. However . . . it cannot fail to differ considerably from what we consciously and explicitly consider as mathematics.'

In large organisations the computer, by virtue of the problems it creates and the thought required to solve them, may one day give managers

More Time and

OVER the years the literature on electronics, or better, perhaps, digital electronic computers, has become riddled with applications. When applied to the more commercial practices we see that integration of data processing has become the current theme. We see from press mentions that these electronic 'brains' will not replace, or be a substitute for, management thinking. And, as time passes and the glamour wears off, computers may well become just another machine.

It seems that very little thought has been given to the effect that computers will have on the future pattern of a large scale enterprise or on management itself. That such problems should be considered is of great importance because I believe that their success or failure may well depend upon the environment in which they function rather than upon their ability as engineering achievements in the shape of machines.

Big Business

The advent of computers coincides with an era wherein we see the development of the large scale enterprise; the latter may have been the cause or assisted in the generation, the former the effect

If literature and the spread of knowledge generally is taken as a guide to the direction of the thinking in such matters, there would seem to be a conflict between, on the one hand, management—those who guide and direct activities in the large enterprise—and, on the other hand, the technician who develops the computer and its applications.

In the first place management has recognised that the first need of an enterprise is to survive. In this regard it develops diversification, and builds up capital resources so that in a rapidly changing world it can lose a limb and still survive. It brings about speed in decision-making by decentralisation, by the delegation of authority, all linked with the training of men for managerial posts and speed of communication.

The technician, on the other hand, sees the need to centralise around the computer in order to maximise the machine facilities, and from this central point to feed out to the lower formations. Provided the management view is not overlooked, the two views may not be irreconcilable, but there remains the danger that computer applications may be developed through the clerical level.

by J WORRAL, MBE

Scope to Manage

the 'ends' of their businesses, instead of the 'means'

There are many other dangers inherent in centralisation of data processing, for inevitably there will arise:

1—the need for new channels of data communication;

2—the supervisory requirements necessitated by sheer quantity, and the control problems associated with quantity;

3—the decrease in the speed of providing information on diverse subjects when these have to be fitted into large tasks which call for long machine runs;

4—the possible inflexibility brought about by sheer size;

5—the feeling that lower levels of authority are being bypassed.

'Line and Staff'

The complexity of a modern enterprise emphasises the need for specialists, and we see being built around us the large specialist departments of finance and accounts, sales, manufacturing, distribution, purchasing, etc. In order to provide for the essential communications within the enterprise, methods of organisation are developed, and the fairly common pattern is that of 'line and staff' whereby the direction of the enterprise is through and by the 'line' organisation, and the control, with guidance and advice, through the 'staff' organisation.

As the organisation grows, the need for decentralisation becomes essential if a live structure is to be maintained, and at this early stage confusion becomes apparent. First, the true concept of decentralisation is not always fully understood; we get decentralisation of decision-making confused with physical decentralisation, the latter being at times little more than contracting out to lower formations the physical activity which is, in many cases, an activity essential to the enterprise as a whole. From the physical decentralisation springs the need to provide for co-ordination and the consolidation of the whole, which brings into being large central departments.

It cannot be doubted, when the many functions of staff are analysed in detail, that there is failure to recognise what data the local point requires from which to make local decisions, and what the

central management need to assist in running the enterprise as a whole.

The second point which becomes apparent is that where the decentralisation is of a physical nature and consists of part of a common activity within the total enterprise, we may well find that the actual direction of this activity emanates from the staff organisation, and not the line; in fact, it is a line function being carried out by the staff. There is little wonder that the acceptance of 'line' and 'staff' becomes difficult in practice. It is not the concept that is wrong, but the practice.

Causes of Confusion

To appreciate fully the effect that computers may have on management thinking and on organisation in the future, it is first necessary to ask why this confusion in practice has arisen. It originates, to my mind, with the traditional association of clerical processes with specialist functions usually required of the 'staff' organisation. In the staff organisation there will usually be found the specialist areas, e.g. finance and accounts, statistical, engineering, sales, etc, and in order to advise and guide management through their intellectual skills the need for data has arisen. Thus the specialist, in addition to his intellectual skills, has found it necessary to learn what might be termed the mechanical skills, i.e. those associated with data processing. The more complex the organisation the greater becomes the work load of the mechanical to a point where it submerges the intellectual. Thus we hear quite often that managers have no time to manage.

Waste of Intellect

It seems that we can diagnose this as a fault in organisation which has led to a very considerable waste in technical skills at the intellectual level.

The employment of computers is likely to heighten the confusion. On the one hand the technician sees the computer as the integrator of data processing, a means whereby basic data can be identified in terms of its end use and processed in a straight line. In conflict, management may see such integration through the computer as the building up of a partially inflexible machine, so large that it moves too slowly to ward off, or to absorb the ever-changing conditions, so necessary for the survival of the enterprise. The technician sees the computer as the extension of the mechanical function of the specialist area without considering the greater absorption of the time available to the intellectual skills. On the other hand, management see the activities of the specialists becoming more concerned with the means than with the end, and in consequence have to hire more professional men in order to obtain the intellectual skills. But the more management provide for the intellectual skills the more diffused and wasteful they become due to the sheer weight of the associated administration. Thus management itself becomes disintegrated because of the undue weight of responsibility connected with the mechanical skills, with man management, and all its associated activities.

Management Managing Itself

At this point, and it can often be argued that this point has been reached, management is now too busy managing the means instead of managing the end. It can also be said that many technical advisers to management are also too busy managing their means with insufficient time to interpret the end. Whatever term is applied to that group of men whom we refer to as 'the management,' there is evidence to suggest that their primary function in practice is the managing of an activity or group of activities and not the managing of the enterprise as a whole. These conditions give rise, fortunately, to the emergence of the strong, dynamic individual upon whom falls the very considerable responsibility of directing the future of the enterprise. The main problem is whether

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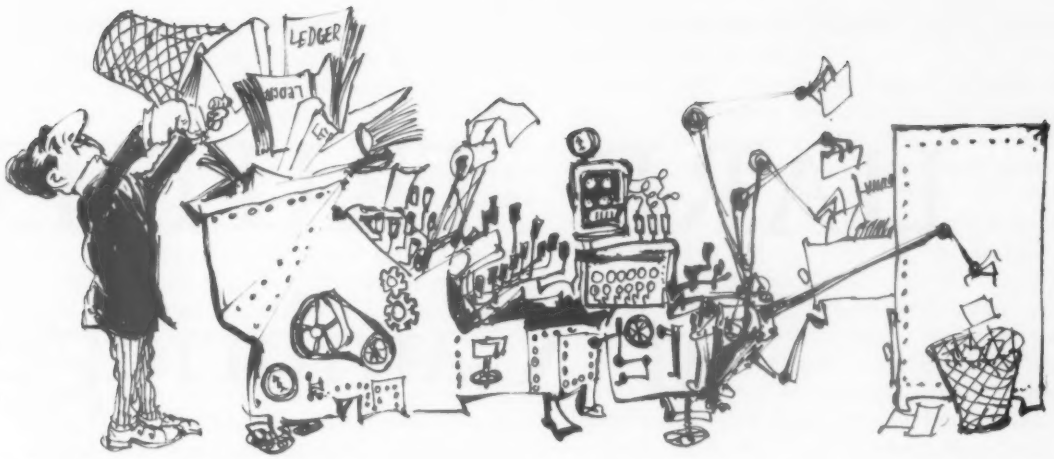
From 1929 to 1946 Mr Worral served with the Army in India in headquarters administration, emerging at the end of that period as Lieutenant-Colonel.

In 1947 he went to the British Petroleum Company in Abadan and worked on manpower statistics and mechanisation until 1951 when he returned to London and joined Shell-Mex and BP.



'The technician sees the computer as the integrator of data processing'

By William Papas

such men can be replaced from staff who have grown up in an atmosphere which has bred functional managers rather than general managers.

Computer Can Help

Can the computer help? I firmly believe that it can and will, not necessarily as a machine but by the very problems it creates, and the thinking necessary to their solution. Thus, if an integrated data processing system is devised for the enterprise as a whole, one of the problems to be resolved is its location in the organisation. Data systems will need fairly rigid control and, in many instances, direction, and since they must be firmly established and maintained, all direction in this matter must come from the central body. Because of the discipline necessary, this will become a line function and, in consequence, should come under line management. Because of the importance to management of statistics, whatever their nature, and the need in the system to aim at minimising data to those which are significant, data processing must be taken to and be directed from management level. It is insufficient to leave data processing at the clerical level, and wasteful in intellectual skills to leave it in the specialist areas. That there must be co-ordination of demands placed on the system, that managers will have to learn to accept a new pattern of reporting, is very evident. All this will need direction; it cannot be left to acceptance.

Benefits of Ills

From this it would seem that some of the ailments of industry can be cured, and at the same time bring about:

1—the release of the intellectual skills and their better utilisation;

2—the higher development of the mechanical skills;

3—the provision of time for managers to manage;

4—the provision of time for specialists to advise management;

5—the full co-ordination of management information.

All this should and could lead to the integration of management as one unit and for the life stream of information to become part of that unit.

HARD TRUTHS at Cambridge

Over 300 people attended the first conference of the British Computer Society held at Cambridge last June

BY the end of the second day of the Society's conference, which lasted from 22nd to 25th June, the sun had reduced the two cohorts within the conference—grey-suited business executives and linen-jacketed scientists—to shirt-sleeve conformity, in spite of the icy blast conferrers received in the morning when Mr J A Goldsmith of Robson, Morrow and Co. reported on 'Commercial Computers in Britain.'

Billed to speak on 'The State of the Art' from the business viewpoint, Mr Goldsmith began by acknowledging that useful work was being done on a number of installations, particularly when the situation was contrasted with that of a year ago. However, the type of work that was at present being prepared for computers was 'fairly low and unambitious.' Furthermore, although 109 computers had been delivered or ordered* there had been comparatively fewer orders in the past year.

Obviously, the computer market has not yet reached its saturation point for, as Mr Goldsmith pointed out, there are over 1,000 firms who employ 1,000 employees or more and these represent the potential in computer installations.

Business men, it appeared, were waiting for two things: some successes, and new developments from manufacturers.

One factor that mitigated against early successes for some firms was that a number of jobs were being put on to computers that could equally well have been done on electronic calculators. As a silver lining in the cloud, however, many firms had in fact installed electronic calculators—100 have been delivered and 300 are on order—and in a few cases the smaller types of computer had been bought in order to acquire working experience; for instance, Guest, Keen and Nettlefold Ltd settled for an ICT 1201 to do just this.

With the larger computers, if most efforts had been unambitious, then also the achievements were very disappointing, considering the preliminary work involved.

In a number of applications the facilities of the computer were not being used to the full. Mr Goldsmith was able to instance this with some examples he had encountered: one example was a stock control and pricing application; previously, before the computer's arrival, pricing had been done on punched cards, and although there had been some revision of card layout, no change of *method* was adopted when the firm began computer working. The computer job was shown to be clumsy.

Apart from clumsy applications, some of the larger applications had done no work at all for months, and there were still at present one or two machines idle. This was explained by the fact that there was a lag—which was not unexpected—between delivery and getting useful work on to a machine, and this hiatus was used as a breathing space for gaining experience: for testing techniques and programmes.

* Sixty-seven card or paper tape machines of which 47 have been delivered, and 42 magnetic tape machines of which 27 have been delivered.

POPULAR APPLICATIONS

Reporting more specifically on the work that had been done, Mr Goldsmith said that payroll was the most popular application that had been attempted. There were 52 installations presently engaged on payrolls, and for very large payrolls the work was being done successfully; however, some companies had found their payrolls terrifying as they outstripped the capacities of their computers.

Of the 70-odd computers installed 34 were being used to help control stocks of finished commodities. Some companies were applying new statistical methods to stock controlling. The Ford Motor Company, for example, in conjunction with Leo Computers were developing statistical techniques for controlling and accounting for spare parts.

In the field of production control and operational research, only 14 firms were tackling production control on their machines. This was disappointing. In view of the savings in time that might accrue from using a computer to control and schedule workloads, this was probably one of the most fruitful fields for computer applications. A good deal of operational research work had been run on machines and produced valuable results, particularly in research on the distribution and distillation of oil.

Analysing some of the difficulties that had been encountered in installing computers, Mr Goldsmith fired a few more gloomy shots: in some cases insufficient staff were employed to get results within reasonable time, in others, insufficient time was allowed to re-think procedures before the computer arrived. There had been failure to organise people to work together on computer projects, and there was still a large gulf between senior managements and computer people—the people at the top 'may not yet have grasped what computer people are trying to do.' Aside from the lack of communication, there was also a tremendous shortage of clever people to organise systems and computer work.

UNIVERSITIES' PROGRESS

Smiling Dr A S Douglas, Director of the Leeds University electronic computing laboratory had more encouraging things to say about 'the state of the art' as it is practised in the British universities. The last two years had seen an acceleration in computer activities at the universities, with seven more universities acquiring electronic computers. Most of the computer departments or laboratories set up adopted an 'open shop' policy both for academic colleagues and for outside business organisations, and most of them ran or would run programming courses.

Apart from those centres where scientists are engaged in designing new machines, the computer laboratories have two obvious functions: to provide a service for scientists confronted with mathematical calculations and problems, and to 'teach computing.' Service to research scientists the laboratories already provide, and will continue to do increasingly. Dr Douglas quoted the great amount of work that has been done in connection with problems in crystallography. As for teaching, most of this is pitched at a post-graduate level. Leeds University, for example, runs Diploma courses in numerical analysis and data processing.

More than this was needed, Dr Douglas intimated: the university centres should train people at the undergraduate level for computer work. He himself had visited firms and uncovered in their drawing offices problems that could be, and were, quickly and economically solved on a computer. But to get anything more than a fringe of the mass of existing drawing office problems tried on a computer required engineers trained to think in terms of computers.

THE COST OF SUPER-MACHINES

Concluding on future work in the universities, Dr Douglas threw open the question of what would happen when the large and expensive computers began to appear.

Obviously the universities will want to purchase these machines—not only because of the work they will perform but to tutor people in their capabilities. Yet these new computers will be vastly expensive, so that in order to get back some of the initial purchase costs, the universities may be faced with the need to raise revenue by taking in data processing work.

What this might entail is not yet clear; an extremely gloomy view might be that this would lead to commercial work swamping the university super-computers at the expense of pure research. This need not happen, but well before the first machine is installed these problems will need to be debated.

With the keynote addresses on the state of the art delivered, the conference got to grips with detailed aspects, following a working routine of lectures and symposia succeeded by discussion.

FINDING PROGRAMMERS

A symposium on the selection and training of programmers delved unconsciously into what might happen when the number of programmers required

exceeded the available stock of graduate mathematicians. Government and industrial research establishments are at present able to cull qualified mathematicians fairly easily for their computer sections. Other employers of programmers, to judge from their advertisements, also demand high qualifications. Will they always be satisfied? Mr R W Bemer, Manager of the Programming Systems of IBM's American data processing division, outlined how he recruited people with no paper qualifications as programmers by first assessing their capabilities with aptitude tests. The demand for people to do programming, he explained, had outstripped the available college graduates, so it had become necessary—in the United States—to recruit in other fields.

No one will state whether programming is considered as a dead-end occupation or as one rung in a promotion ladder. Obviously, the mathematician employed to fit into a research team will probably contribute—eventually—more than a number of programmes; but his business equivalent will probably, like the banker's ledger clerk, be offered no prospects.

That this may be the case was to some extent foreshadowed by one speaker's remarks: he outlined a number of points to consider in relation to employing programmers—for example, to mix know-how with a fresh academic approach, and to make sure programmers understood the detailed operations of computers, but also, to choose plodders rather than brilliant mathematicians, and to allocate individual jobs to programmers so that each man has a precise idea of his own work.

AUDITING COMPUTING DATA

Every company, according to the Companies Act 1948, is required to keep 'proper books' relating to money spent and received, and the sale and purchase of goods, and also to record company assets and liabilities. It is one of the functions of a company's auditors to see that this is done. One problem in the wake of automated office routines is that of visible records.

Computers carry out series of logical operations without leaving any record of the interim stages that take place, and make use of magnetic storage (eg magnetic tapes) where the data filed cannot be read directly. This might worry an auditor in theory as there are no 'checkable' records. A symposium on this topic threw out some suggestions of safeguards that an auditor might ask for, in lieu of records: for example, he might ask for a copy of the programme and wish to do test runs to satisfy himself that the system operated 'on the level.'

Whether companies with automatic data processing systems will worry much about this is doubtful; just as it is doubtful whether auditors will lose sleep over the disappearance of records. The letter of the act—'proper books'—may well be quietly forgotten; and even if it is true, as one speaker pointed out, that most frauds have been perpetrated by exceedingly clever men, it is not clear that any of the safeguards suggested would ever bind future clever men to the spirit of the act.

ALGOL AND ALL THAT

Will a standardised machine language—an electronic Esperanto, as it has been dubbed—become generally accepted? This was discussed in relation to a paper on automatic programming prepared by Dr S Gill of Ferranti Ltd.

The machines that have been developed in the last few years have each been provided with distinct machine languages. The upshot of this is that programmes written for one machine cannot be used for another until it has been re-written in the second computer's language. A number of organisations in Britain and the USA already possess several machines—in particular, governmental set-ups—so the problem of inter-machine communications is not as remote as might initially be suspected. Furthermore, the next development of data processing systems might well throw up a 'network' system of small computers for processing data in the field, reporting to a headquarters. Here, too, communications would matter.

At present a special committee of the British Computer Society is studying Algol—a proposed machine meta-language favoured by European and American experts. Adopting Algol would mean that each computer would need to be provided with a special programme for translating from its language to Algol and vice versa. Programmes could then be written in Algol, and then by using the 'translating' programmes, might be applied to any machine.

Other conference topics ranged from the use of magnetic tapes for data processing work to logical design and scientific computer applications. In all the conference comprised some 13 lectures and symposia, though with parallel sessions arranged for the specific interests of the two cohorts, some delegates probably went home in total, and possibly thankful, ignorance of what passed at some of the symposia. PM

TRAINING COURSES

The following list of courses is reproduced by courtesy of *Technology*, the review of training and education for industry, published by *The Times*, in whose August number it originally appeared.

ACTON
THE BRUNEL COLLEGE OF TECHNOLOGY
Chemistry Department
Programming the IBM 650: 20 sessions (E): £2: October 5. Modern Computing Methods: 21 sessions (E): £2: October 1. Industrial Statistics: 20 sessions (E): £2: October 8.

BIRMINGHAM UNIVERSITY
Institute for Engineering Production
Operational Research: 2 weeks (R): £57 15s.: August 31 (Repeated on December 7). Production Planning and Control: 2 weeks (R): £57 15s.: September 28. Organization and Methods: 3 weeks (R): £84: November 9.

BRADFORD INSTITUTE OF TECHNOLOGY
Department of Mathematics
Electronic Digital Computers in Industry: 6 sessions (E): £2 5s.: October 13.

BRIGHTON TECHNICAL COLLEGE
Electrical Engineering Department
Pulse Techniques and Magnetic Storage Devices: 12 sessions (E): £2: September 23.

BRISTOL COLLEGE OF TECHNOLOGY
Physics and Mathematics Department
Computing Methods for Technicians: 8 sessions (E): £1 1s.: October 7.

CARDIFF
THE WELSH COLLEGE OF ADVANCED TECHNOLOGY
Department of Mathematics
Computer Appreciation: 10 sessions (E): £2 2s. Computer Programming: 10 sessions (E): £2 2s.
Department of Commerce and Administration
Organization and Methods: 2 terms (E): £1 5s.: September 24.

COVENTRY TECHNICAL COLLEGE
Department of Commerce
Office Organization and Method: 6 sessions (E): £1: October 14.
Department of Mathematics
Programming of Digital Computers: 12 sessions (E): £1: September.

DARLINGTON
COLLEGE OF FURTHER EDUCATION
Science Department
Principles of Automatic Process Control: 6 sessions (E): £1 1s.: October 7.

DONCASTER TECHNICAL COLLEGE
Mechanical Engineering Department
Quality Control: 1 day: November 25.

EDINBURGH
HERIOT-WATT COLLEGE
Electrical Engineering Department
Autocode Computing for Pegasus: 8 sessions (E): £5: October 12.

ENFIELD TECHNICAL COLLEGE
Production Engineering and Management Department
Control Engineering: 30 sessions (E): £2: September 29.
Department of Electrical Engineering
Electronic Analogue Computers: 10 sessions (E): £1: October 6.

HATFIELD TECHNICAL COLLEGE
Electrical Engineering Department
Automatic Control Systems: 20 sessions (E): £1 1s.: October 7.

LEICESTER COLLEGE OF TECHNOLOGY AND COMMERCE
Department of Mathematics
Data Processing using Pegasus Autocode: 6 sessions (E): £1: September 29. Data Processing using Deuce Alphacode: 6 sessions (E): £1: November 10. Matrices: 10 sessions (E): £1 10s.: September 14.

LIVERPOOL UNIVERSITY
Extra-Mural Department
Industrial Applications of Computer Systems: 2 days (F): £12 12s.: November 10-11. Commercial Applications of Computer Systems: 2 days (F): £12 12s.: December 8-9.

MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY
Mathematics Department
Matrix Methods-Digital Computers: 10 sessions (E): £1 10s.: early in October.
Department of Industrial Administration
Operational Research: 22 sessions (E): £3 3s.: October 14.

NEWCASTLE UPON TYNE
RUTHERFORD COLLEGE OF TECHNOLOGY
Department of Mechanical and Civil Engineering and Naval Architecture
Instruments and Automatic Control: 12 sessions (E): £1 1s.: October.

NORTH HERTS TECHNICAL COLLEGE
Department of Mathematics
The Programming of Electronic Digital Computers: 8 sessions (E): and 12 (E) in Spring term: £1 10s.: October 20.
Department of Science and Electrical Engineering
Electronics and Automatic Control: 10 weeks (F): £5: November 2.

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE
Arts and Commerce Department
The Uses of Electronic Computers for Commercial Purposes: 8 sessions (E): 11s.: October 15.
Department of Electrical Engineering
Transistors: Theory and Application to Switching Circuits: 12 sessions (E): 11s. October 1. Automatic Control Systems: 10 sessions (E): 11s.: September 29.

SOUTHALL TECHNICAL COLLEGE
Department of Electrical Engineering
Analogue Computers: 10 sessions (E): £1: October 7. Digital Computers: 12 sessions (E): £1: September 29. Automatic Process Control: 18 sessions (E): £1 10s.: October 5.

SUNDERLAND TECHNICAL COLLEGE
Electrical Engineering Department
An introduction to the Theory and Practice of Automatic Control Systems: 8 sessions (E): £1 1s.: October 14.

TWICKENHAM TECHNICAL COLLEGE
Department of Engineering
Computer Programming: 18 sessions (E): £1 10s.: October 12.

KEY

D—Part-time day course
E—Part-time evening course
R—Full-time residential course
F—Full-time non-residential course

A measure of 'integrated' clerical work has already been achieved at Bristol Aircraft with the introduction of two electronic calculators and a subsequent inter-meshing of several data processing tasks

Bristol Aircraft's Approach to 'Complete Control'

by G J Pierce
Organisation & Methods Officer, Bristol Aircraft Ltd.

A FULLY integrated data processing system may eventually require a computer, but experience can be gained and advanced techniques built up with the help of conventional punched card equipment. In fact, to think in terms of equipment is to approach the subject of data processing from the wrong end. The aim is to establish complete control in an organisation, and the means by which this is achieved are data processing machines, which may be conventional or may be computers—whichever are appropriate.

An example of the way in which over recent years a high degree of integration has been achieved on punched card equipment is to be found with Bristol Aircraft Limited. Both this Company, and its sister Company, Bristol-Siddeley Engines Limited, have large installations supplied by IBM United Kingdom Limited.

All Major Accounting Activities

IBM equipment was installed at Bristol Aircraft Limited in February 1956. It now includes two IBM 604 electronic calculators and present work covers all the major accounting activities including labour costing (including the calculation of wages and salaries) and material accounting (including financial stock control), development and production job costing, departmental cost summaries; and work is now proceeding to make the stock record the basic stock record for all purposes within the company.

Since this equipment has been installed, large financial savings have been achieved, clerical work

has been reduced and greater control of capital, revenue and development expenditure has been established.

Works Payroll and Labour Costing

PAYROLL alone is of course a very usual application for data processing equipment, but at Bristol Aircraft Limited it is seen in relation to the wider subject of machine load job costing and labour incentive schemes, and the punched cards used in this work are later used for the control of expenditure.

Employees clock in on 'job cards' only, and these cards contain the details of a particular job. Up to 100 men may be concerned in one job. A premium bonus scheme is in force for the majority of direct workers and all those taking part in a job are entitled to a share in it. For this reason the record of each man's work is recorded on 'operator time cards'—cards held by the timekeeper for each man and containing the man's particulars and a linking code, so that they can later be related to the appropriate job card. The timekeeper extends the daily clockings and, when a job is completed, he totals the time that individual employees have spent on it and marks this on to the operator time card.

Job Cost and Bonus Calculations

THE time cards and their corresponding job cards are then sent to the machine room where calculations on job cost and bonus are carried out on an IBM 604. In two runs the total bonus percentage and earnings are first calculated and punched into the job card, and then the bonus is apportioned to all the men concerned, according to the time they have spent and their bonus rate. At the same time the total job cost is balanced with the time earnings and bonus on the individual cards.

The time cards are then used to produce bonus statements, and also a summary card showing total earnings, bonus and hours worked for each individual. These summary cards are next used for payroll operations.

Payroll Operations

GROSS pay is calculated, the total hours worked times basic rate plus bonus being compared with the accumulated job card totals. Tax and net pay are then calculated on the 604 at nearly 6,000 employees an hour. The payroll itself, as well as departmental totals of wage, tax and deductions details are printed on an IBM 421 accounting machine. The payslip is also printed and a coin analysis made. The payslip is given to the employee two days before he is paid so that he can examine his earnings well in advance.

In order to facilitate the quick preparation of costing information, the complete payroll and labour cost calculations, which are automatically balanced together, are completed by Monday at approximately 3 pm for the week ending up to the previous Friday night.

After the installation of IBM equipment, the size of the payroll increased by over 25 percent to nearly 12,000 employees. This did not mean, however, an increase of staff in the wages and accounts department: on the contrary, it has not been necessary to replace many of the staff who have left.

Material Recording and Costing

FURTHER cards used for the control of expenditure are obtained during the course of the control of material.

For the system which is concerned with some 64,000 items of stock with an average of 25,000 to 30,000 movements each week, an average price system is used.

The goods received notes may be priced at 'invoice price' or 'average.' If no invoice has been received at the time of transfer of goods to stores after inspection, then the goods are priced at the previous average price.

When the goods received notes reach the IBM department, cards are punched and the average unit price calculated on the IBM 604. Receipts priced 'at average' are later adjusted, if necessary, and adjustment cards are prepared for price changes.

A bin card is held in the stores for each item. Quantity balances are checked by machine against the storekeeper's bin card balances. A complete financial balance is provided in the tabulation, ensuring that the value of the closing stock balance equals the value of the opening stock balance plus receipts less issues.

During the three years that IBM equipment has been used, the variation of material used has increased, yet savings of 50 percent in handling have been achieved. The great advantages, however, lie in the weekly financial balancing that is now possible and the fact that the IBM record is always in step with that of the stores, thus ensuring that the cards which are later used for material costing are accurate. At the end of the year a listing of stock cards is accepted instead

of physical stocktaking, thus accomplishing in two days a task that formerly necessitated many weeks of preparation prior to the year end. In addition two weeks plus a large calculating service operation outside the company after the year end were formerly needed. Details of stock are provided to production control to know free stock available and to re-order where necessary, to the estimating department for the latest prices and to the commercial department for sales of stocks available for disposal.

Expenditure Analysis

THE total value of the job cards equals the gross wage for the week on the payroll, and the total of the material transaction card equals the value of materials issued from the stores. It is these cards, together with others punched for additional direct expenditure, that are used for an analysis of expenditure.

They are first sorted by accounting number, which is a code representing, in the case of production expenditure, the manufacturing order number, and in the case of overhead expenditure, the departmental number and overhead expenses code. In both cases, summary cards are punched for each accounting number.

For production expenditure, a manufacturing order control is maintained from the accounting number. This is summarised into contracts for recovery of expenditure and progress claims. Further analyses are made under various heads for long term planning. The details cards are used for work in progress and batch costing.

Cards in the indirect category are used to produce departmental cost summaries. These show expenditure under some 60 headings, giving period and year-to-date figures compared with the budget for the use of over 100 departmental heads. They also show departmental expenditure by groups of departments for the various group managers.

Expenditure statements for capital, revenue and development expenditure are prepared, showing recordings of work and outstanding commitments, both for the period and for the year to date; these compare expenditure with that sanctioned by the board, or the estimates within agreed budgets. A consequence of using IBM equipment has been that progress payment claims have been produced earlier and control of development expenditure is being facilitated.

Job Costing and Production Control

THE direct job cards and material requisitions are sorted within manufacturing order to part number and these are progressively collated into the work-in-progress file for the various operations until the completion of the job, when all the cards for that job are collated out. The cards are then passed through the 604 where the total cost for the job and the unit price per piece or assembly produced is calculated.

Several independent jobs are processed for production control; at present these include machine and shop loading and parts progressing.

Developments Now Being Programmed and Tested

THIS company is at present introducing a completely integrated spares system. From customers' enquiries the procedure will give delivery dates and extended prices. A complete stock record will be maintained of customer's orders, physical stock, free stocks, orders on production with promised delivery dates, with a selling and standard cost value. As spares are available to meet orders becoming due for delivery these will be automatically picked up in the system and the despatch paperwork and invoices prepared. Not the least important point of this system is the speed with which customer's enquiries can be dealt with (24 hours) and such important statistics as value of spares in stock and orders on the shops and many others can be determined.

In addition to the spares application, active study is being made of the possibilities of a completely integrated production control system which, in turn, will interlock with the accounting and spares procedures.

Some of the special exercises which have been carried out on the IBM 604 and other equipment include:

1. The calculation of new national insurance deductions and new total deductions without sorting the history cards;
2. Calculation of new pension deductions and new totals;
3. Calculation of various wage and holiday pay awards;
4. Calculation of slow-moving stock, with numbers of special exercises for the control of surplus;
5. Personnel information such as length of service, age groups, etc;
6. Dividend and tax calculations;
7. Information for statistical sampling.

Disclaiming that they have been asleep whilst data processing developments have taken place, bankers claim their business is one of giving 'clerical service,' and to mechanise this is a much more complex task than appears initially

THE BANKS PLAN FOR THE FUTURE

by **R HINDLE**
Organisation and Methods Research Officer, Martins Bank Limited.

THERE is a tendency to think in these days that the use of electronic data processing equipment is evidence, and indeed the only possible evidence, of progressive systems development. It seems natural to assume that those who have not rushed into the new field are as a result backward in their thinking. This is not really so. Electronic techniques do not offer a cure for all operational ills. Their use has come to be carefully studied before attempts are made to apply them, and indeed it will be found quite often that such application is not to be recommended.

ACCUSATIONS OF BACKWARD THINKING

BANKS have suffered as much as any others from the accusation of backward thinking and the perpetuation of old-fashioned methods. The undoubted fact that they employ a larger proportion of clerical to other types of labour than most other businesses can be taken out of context and used as evidence to support the accusation. The fact is that such a large proportionate use of clerical workers is inevitable just because their sole business is clerical. Their clerks are not supporting a manufacturing organisation, they are actually manufacturing the end product. By virtue of this argument, also, a change in their clerical methods is of far more fundamental import than it would be to some others.

There is the further complication that these clerical processes are at all times exposed to close contact with the customers, to whose needs they have to be conditioned, rather than to the needs of the bank itself. After all, it is an accounting service that the banks are selling. The wise manufacturer produces as cheaply as he can, but it will avail him nothing if he cuts his costs and as a result produces goods unacceptable to the public.

It is not really true that the banks have made no progress in systems developments in the past few

decades. They have been on the hunt continuously for new methods and new equipment. The machine manufacturing companies will probably admit that encouragement given them by the banks has played a large part in the development of new projects and in maintaining production of their advanced equipment. The main deterrent within the banks has often been the expected disinclination of customers to accept change.

AMOUNT OF BUSINESS INCREASING

AGAINST this background the banks now look forward to new developments. The number of accounting entries that they are handling has shown a steep rise in the past years and there is no reason to believe that use of the banking system has reached saturation. Apart from the normal law of growth, two exceptional influences are at work. The agitation for the repeal of the Truck Acts will not in itself persuade workers to accept the use of cheques as a means of paying wages, but the agitation would hardly have arisen if the exponents did not think that they had a fair chance of making use of the change in legislation. Probably the right way to proceed is to show workers the advantage that would accrue to them if they operated a banking account. The wage payment would be a matter of passing a credit to his account in these circumstances. This would be more satisfactory both to the worker and to the banking system than the alternative considered, which requires that a cheque be given to him, which he then has to deal with himself.

This argument leads to the second influence. The recent announcement that the banks are exploring the possibilities of extending the use of credit transfer facilities could result in the offering of a type of banking account more attractive to those not at present using banking services, and also of providing a means for collecting periodic payments. So a considerable increase in the number of items handled can be expected.

FORM OF INPUT DATA

THE basic form of data to be injected into the banking systems of the future must remain, it seems, as pieces of paper, and indeed pieces of paper produced outside the organisation and control of the bank. The immediate task, therefore, is to find ways and means of translating the data conveyed by the vouchers into the language needed by the equipment to be used. The decision to use as a common language Arabic characters printed in a magnetisable ink has already been referred to in this journal.

What is the information that has to be conveyed? There is a basic need for three blocks, i.e.:

1. The destination bank and branch, this being needed because a large proportion of vouchers debit and credit need to pass from place to place. For entries that are to be completely processed at the office of origin, of course, this information is superfluous.
2. The identity of the account to which the entry has to be passed.
3. The amount of the transaction.

The common language code is purely numeric. This is the reason, of course, why the banks when thinking of automation have to eliminate the alphabetic content of data, apart from a few standard symbols, and not any inability on the part of electronic equipment to deal with alphabetic data. A purely numeric code is chosen because the recognition of only ten characters (plus a few special forms of character) results in a lesser order of ambiguity and therefore is likely to be cheaper and more reliable, and also because the process of conversion to code would be more laborious if the use of alphabetics were attempted.

USING THE NUMERIC CODE

THE need, then, is to express the three blocks of information numerically. There is no difficulty with regard to the amount, which is basically numeric. Branches are normally designated by alphabetic name, this being, in fact, the town (or part of town where there are two or more branches located in a town) where the branch is situated. It has long been realised however that a numeric identity is more convenient and a 'national number' system identifying bank and branch has been in use for a long time, supplemented for manual sorting purposes by a sorting code which varies from bank to bank.

The banks have given a lot of thought to problems of automatic sorting. Batches of cheques going out to different branches vary considerably in size, and for the greatest efficiency and economy the banks seek for 'selective sorting' systems which will off-sort the larger batches at the early stages in the sort. Technically the most attractive way to do this is to use the national number as a key and to provide an electronic control for the sorter which can be programmed to off-sort the branches in any desired sequence. To provide such an electronic control would be expensive,

Designed for posting debits and credits to ledger cards and statements, this automated Post-tronic machine, produced by National Cash, can be activated by punched paper tape

however, and by far the more attractive scheme from an economic point of view is to incorporate the desired 'programme' in the numbering system. This, of course, will require the abolition of the present national number system and the introduction of a new numbering structure. This will be well worth the effort.

NAME AND NUMBER

BANKS have always identified their customers by name and, generally speaking, from a manual operating and managerial point of view this will certainly continue. It is recognised now that the accounts will have to be numbered for an automatic system, and that for manual systems also the numbering of accounts could be used with advantage to distinguish between accounts with similar names. The use of semi-electronic machines such as Post-tronic and Sensitronic will require account numbering. Consequently the science of allocating account numbers—the need for ' alpha-numerics ' in a full or limited form—is being given careful consideration.

In addition to the three basic data blocks the need for the cheque number has been referred to previously. This serves to identify a particular transaction for two purposes. It is used to decide if a cheque presented is in fact one of which payment is stopped by the drawer—the payee's name and amount is insufficient because the drawer might have issued a duplicate. The more controversial use is to provide 'narrative' or description. Many banks in England continue to type in a payee's name or other descriptive matter alongside each item on a customer's statement. Alphabetic description by automatic means is impracticable because of the numeric code to be used, as already explained, and in any case would be prohibitive owing to the difficulty in getting the data coded onto the cheque. The only description that can be contemplated is the cheque number, or some part of the number. In the case of debits

other than cheques, or credits, no identifying number is available and the description given is chosen from a limited number of standard alphabetic abbreviations. So far as the equipment is concerned, such abbreviations can be represented by a numeric code. It is very difficult indeed to understand why any description should be given if vouchers are returned to the customer with the statements.

THE TRANSACTION CODE

A FIFTH item of information to be considered is known as the transaction code. This identifies the type of transaction and instructs the equipment to be used which of the various courses of action programmed it has to follow in each case. The basic purpose of the transaction code is to specify the sign of the transaction, i.e., whether debit or credit; and if it is decided that this is all that it has to do, no doubt it will appear adjacent to, and perhaps even in the same block as, the amount. Some think, however, that it will be used to give a more explicit definition of the transaction, perhaps even to the extent of indicating which of the narrative codes is to be used. Under these circumstances the transaction code is thought of as a separate entity.

APPLICATION OF THE CODES

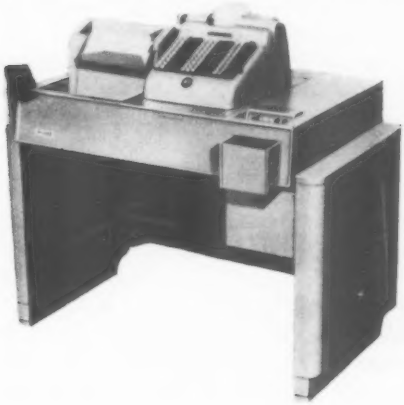
IT is significant now to consider when and how these five data blocks will be put on the voucher in the special Arabic characters with magnetisable ink. The bank and branch code number needed for vouchers that may pass between branches is known at the time of printing the voucher and so can be put on by the printer. The serial number (or description code) is also known and can be put on at the same time.

The account number can be printed by the cheque or other voucher printer only for the larger accounts for which special cheques are produced at present. For others, stock cheques have to be held and these will have to be imprinted with the account number when the customer asks for a supply. One method would be to keep at the branch one book for each account, each book containing both cheques and credit slips, and each cheque and slip imprinted with the appropriate number for the account. The other method is to provide the branches with the means whereby they can imprint cheques on demand. In the former case it is unlikely that a cheque printer can oblige and consequently the bank must be prepared to do the task itself, though the process could be centralised at regional offices; in the latter case even a form of centralisation would be impracticable unless provision on demand can be stretched to mean delivery by next post.

The account number only will serve as account identity from the point of view of an automatic system but there are other operational reasons why

Reckoned by the manufacturers to be the fastest document sorter in the world, this machine reads characters—printed in magnetic ink—on cheques and other documents, and sorts them at the rate of 1,560 a minute

This printer, developed by Burroughs, will imprint on cheques a cash value and a customer's account number in magnetic ink. Amounts encoded are simultaneously added and listed on a tape for reference and proofing



A 'qualification printer,' produced by National Cash, encodes in magnetised characters information relating to account number, etc, where it is not possible to pre-print these data

the account name also should appear. Firstly, it is not intended that the customer should believe that he is thought of as a mere number. Secondly, one of the paying bank's staff has to examine each cheque and authorise payment. He will need to be certain that the number on the cheque correctly represents the account indicated by the signature. He cannot be expected to remember all the account numbers and it would take too long to refer each voucher to a cross-reference index, but he can see if the signature agrees with the printed name. Once he has authorised payment, members of the staff, usually junior in experience, who handle the cheque subsequently for routine purposes, will recognise the account by means of the unambiguous printed name.

MACHINES AVAILABLE FOR 'PERSONALISATION'

MACHINES to print account number and name are already available and others are in course of development. One is the already well-known Multilith for which paper masters are typed and used once only. Loose cheques are used with this method. An imprinter using type set in a holder, one such holder being made up for each account and stored for repeated use, is available from Burroughs; this also needs loose cheques which can be bound after imprinting. A third form of imprinter is being developed by the addressing machine companies in this country. These will use ordinary addressing plate principles as the basis of the technique. They will be cheaper than the other versions mentioned and are intended to imprint cheques already bound in books. Thus they may be more suitable for the 'on demand' issue system. The process of putting name and number on the forms is known as personalisation.

All the above data is printed on the cheque, etc, in code, before the blank is issued for use by the customer. In the case of amounts, however, which are known only when the cheque or credit form returns into the banking system, a different technique will have to be used. Ideally, all branches of all banks would so encode all items received by them over their counter for other banks and branches so that from that point onwards automatic operation would be practicable, but as the problem is seen at present it is unlikely that all the small branches throughout the country could be so equipped. The larger branches might perform such a service but for the rest an encoding section in the central clearing department is likely. This will then permit a fully automatic clearing system.

The method of encoding amounts, for which purpose machines are being developed and have been demonstrated, is to make the process a by-product of a normal listing process so that use of the list proves the accuracy of encoding. The unit is a normal adding machine except that it has a second printing station. The amount having been set up on the keyboard, it is printed on the usual

Continued on page 50

Data Digest

Extracts from recent articles and papers on various aspects of automatic data processing and computer techniques throughout the world

Four American Visitors Review

RUSSIAN PROGRESS IN CYBERNETICS

John W Carr, Alan J Perlis, James E Robertson and Norman R Scott

A Visit to Computation Centres in the Soviet Union

Communications of the Association for Computing Machinery (USA)

The authors spent two weeks during August and September 1958 in Moscow, Kiev and Leningrad. They were shown seven different Russian computers: the Strela, BESM I, BESM II, Ural 23, Ural 38, Setun and Kiev. The Setun and Kiev were still under construction.

A good deal of work was being done in all three centres on automatic programming, the most advanced work being done in Moscow, where the best equipment and the most highly trained workers are. A P Ershov, one of the principal designers of the programming system, has written a book describing the construction features of the translator, including flow charts and their analysis of each of its important parts.

Moscow University has a large faculty of computer mathematics, with a staff of 40.

The Russians have been pioneers of machine translation of languages, and there is a specialist group of about 40 linguists at Moscow. Work in English-Russian translation was concentrating on the problem of polysemantic words. There was talk—but no more—of a computer specifically for language translation.

ACHIEVEMENTS OF EAST AND WEST

Comparing Russian and Western achievements and machines, the authors considered Russian technology in production control of equipment was not as advanced as in the West; but the Russians seemed to be ahead of Britain in automatic programming and ahead of everyone else in the *theory* of automatic programming.

'There are obviously more and better logicians and mathematicians connected directly or indirectly with computers at Moscow, Kiev and

Leningrad universities than at any universities in Western Europe or the United States.'

There is a growing interest in cybernetics throughout the Soviet population and, despite a slow start, 'Soviet use of computers may be expected to surpass in quality and quantity that of the United States, that is, unless the top-notch American mathematicians wake up to their responsibilities.'

Clifford S Willis

Challenge—not Threat—to Office Workers

Punched-card Data Processing May-June 1959 (USA)

Automation is everywhere speeding work in offices, doing it more efficiently and more cheaply. This is a challenge to office workers, not necessarily a threat to security. The progressive employee should analyse his own office procedures and get to know automation equipment and systems.

The average office worker is shy of automation; but it means simply the co-ordination and proper layout of work and the elimination of drudgery.

Much anxiety is due to the common human fear of machinery; but office workers once feared the typewriter and the adding machine.

Automation implies changes in organisation but not in wholesale displacement of workers. Office workers should learn how to fit into the pattern of automation, to treat it as a challenge: it could be the opportunity for a bigger and brighter future.

Business Research Corporation, Chicago

A Survey of Machine Accounting Salaries

Management and Business Automation June 1959 (USA)

A survey based on reports from 200 firms in 21 American cities. Salaries of machine accounting managers, in dollars per week, are tabulated in relation to the size of the installation, expressed in terms of 'median points' (average monthly equipment rental value, in dollars).

Managers' salaries range from $96 per week on a small installation to $293 per week on a large installation. These are the two extremes in the survey. The national average is $163. Salaries of other machine accounting personnel tend to vary according to geographical location rather than size of installation—relatively high in Chicago, low in Dallas.

The majority of installations are the responsibility of the controller, though some 15 percent report to the chief accountant. About six percent of companies have a director of central data processing. Normal working week for all machine accounting staff is 40 hours, with overtime pay for anything in excess of this.

PAPERS FROM THE PARIS CONFERENCE

Continued from the July issue of Automatic Data Processing

I K Belskaya (USSR)

Machine Translation Methods and their Application to Anglo-Russian

An account of a scientific research which has resulted in devising a procedure for machine translation of different languages into Russian.

Methods evolved for translation purposes are illustrated by the Anglo-Russian scheme. The heart of the method lies in the most careful description of every language included in the machine translation scheme, a very detailed comparison of these descriptions being the basis of machine translation research.

The comparison of the English and Russian languages in the course of machine translation studies has proved to be more fruitful than could have been supposed, in so far as the structure of these languages has been found strikingly alike. An attempt was made to work out an Anglo-Russian machine translation scheme where maximum similarities found in the structures of the two languages could be used.

The translations obtained are quite adequate for understanding and do not require post-editing.

S Takahashi, H Wada, R Tadenuma and S Watanabe (Japan)

English-Japanese Machine Translation

Since the grammatical structures of both languages are quite different, the 'word for word' translation such as might be possible between European languages is generally unsuccessful. The programme described has an aim of finding out the grammatical structure of the given English sentence first and transposing the words in it so as to meet the corresponding Japanese grammar.

It takes about ten seconds to translate a simple sentence such as 'I have some eggs in my hand,' including the time for input and output.

A transistorised computer having 600 transistors and 7000 germanium diodes as switching elements is used.

A New Desk-size Computer

THE new computers that are becoming available to British firms represent a move in two directions: they are either much larger or much smaller than those with which we are already familiar.

The latest machine that is being added to the range of available small computers is the LGP-30 which is manufactured by Royal McBee International Inc in Geneva. Priced at around £15,000, it takes up little more room than a typist's desk, and as it is mounted on castors, it can be moved from place to place. It can operate from any ordinary power point.

The LGP-30 is a serial, single address, fixed point, binary and stored-programme computer. It fills the needs for a small-sized and low-priced scientific device. Its large magnetic drum memory holds 4,096 words, which gives the machine sufficient memory capacity for the majority of complex scientific problems it might be assigned to solve.

With its relatively simple command structure, it is anticipated that the machine's operation can readily be mastered by the average engineer, while non-technical staff may be trained in a short period to carry out actual computer runs.

A 'universal' computer, the LGP-30 is suited for a wide variety of applications: it can be used, for example, for solving problems involving matrix inversion, simultaneous and partial differential equations, least squares fit, etc., and for analyses of regression variances, trajectories and linear systems.

The machine will operate on both alphabetical and numerical information. It works internally in binary, which has permitted engineers to simpify its design, yet this imposes no restriction on the operator, who enters his information in decimal form and receives results in the same form, the conversion being made by a standard input-output routine stored on the memory drum.

The memory drum provides for 81 magnetic recording channels, each equipped with one or more read and record heads. Sixty-four of these channels comprise the main memory, used for storing data to be operated on, and for computer instructions.

Accessories

Reading Magnetic Tape Slowly

EQUIPMENT has been developed for reading magnetic tape recordings of digital information at very slow speeds or even when stationary. It is now possible to operate such devices as typewriters, teleprinters, paper tape punches and card punches directly from magnetic tape. As off-line equipment the slow speed reading system may afford valuable economies in computer operations and in data logging systems.

The reading heads used are flux-sensitive, and a magnetic field adjacent to the reading gap causes an output due to changes in reluctance through the magnetic path in the head.

Constructed in stack form the head caters for any track spacing. A typical specification is for an 8-channel head, reading half-inch tape with recording tracks 0.04 inch wide and separated by 0.02 inch. Staggered tracks can also be catered for.

Excitation for the flux-sensitive heads is supplied by an oscillator common to all reading gaps on a head. The frequency at present in use is 100 kc but this may be increased in order to permit a higher maximum speed of reading, if this is required.

The slow speed reading system has already been applied to typewriters and teleprinters. The machine being driven is arranged to provide a feed-back signal which controls the tape transporter. This enables a typewriter or teleprinter to operate at its own maximum speed and ensures that no characters are lost during carriage return and line-feed operations.

The present equipment is capable of reading at all speeds from 0 to 10 kc, but there is no reason why the upper limit should not be increased. This may be required in cases where it is desired to search for a particular portion of tape and then print out the information contained therein.

Ultra Electric Ltd,
Western Avenue,
London, W3.

Data Logging on Magnetic Tape

EXHAUSTIVE testing and analysis of test data is frequently necessary in modern industrial systems. Advances in measurement techniques ensure that there need never be too little test data for the engineer. He is more likely to complain of the lack of means to record and analyse adequately the mass of data he is capable of producing.

Magnetic tape recording and reproducing, the result of intensive research in recent years, provides industry with useful recording systems. Solartron have now developed a magnetic tape recorder-reproducer system designed especially for industrial applications.

The metal construction of the recording and reproducing heads ensures dimensional stability, the most important factor for determining faithful, accurate reproduction. The head stacks are mounted on a stainless steel base plate, ground optically flat to an accuracy of 50 micro-inches, located automatically by dowel pins let into the plate.

Tape drive is provided by generously rated reel motors and a precision capstan motor to control tape speed. Special take-up and braking systems ensure smooth tape acceleration and deceleration.

A carefully designed pinch roller system, which operates only when the tape speed is matched to the capstan drive, ensures that there is no snatching of the tape when it is started. Attention has also been given to the brakes, to combine rapid deceleration of the tape with gentle handling.

The Solartron Electronic Group Ltd,
Thames Ditton,
Surrey.

New Analogue Equipment

ONE of the latest analogue machines to be brought into service is the KAE 1 which was designed and built at the control and electronics department of English Electric at Kidsgrove, Stoke-on-Trent.

This equipment was primarily designed to assist the Company's engineers in the study and solution of servo problems encountered in the design of control systems for the many forms of electrical drives.

A feature of the KAE 1 equipment is the ease with which the problem can be set up and the rapidity with which a study of changes can be made simply by

THE BANKS—*continued from page 45*

paper roll or form in the carriage but is also held in a second printing head. The cheque is then dropped into a slot into the machine. At the next cycle the cheque is aligned under the second printing head and receives an imprint of the amount in magnetisable ink. This machine can be used also to put the account number on the occasional vouchers that will filter into the system without personalisation.

SORTING OF CHEQUES

VOUCHER sorting machines are anessential for automatic systems. They will be applied in the clearing department, where they are needed to sort cheques into order of branches, and in the accounting centres to sort vouchers into account order. Such machines, operating at speeds up to 1,500 documents per minute, have been demonstrated already and others are expected. The function of these machines is not ended when sorting is completed. Vouchers are then expected to be passed through the machines once more, this time without sorting, information being read off them automatically and fed to listers or to magnetic tape units operating off-line, from which it can be fed into the computer. Alternatively, the sorter/reader, operating in the reader mode, can be a slave operating on-line to a computer system in which the computer controls the reader, calling on it to read another voucher when it is ready to accept the data.

Possible computer configurations for operation eventually with the above peripheral equipment have been investigated and considered even from the point of view of use before the automatic reading devices are available. Punched card and punched tape input systems, the tape or cards perhaps coming as a by-product of some machining operation, are likely inputs.

The above, it is hoped, will serve to indicate that the banks have not been asleep whilst developments in automation have been taking place; indeed, by setting up a committee to develop basic techniques on behalf of all banks jointly and to ensure that the methods of one bank will not clash with the needs of the systems operated by others they may be considered as setting an example to other potential commercial users of automatic systems. Perhaps such co-operation will need to be extended further in the future, so that banks and commercial users can attempt to develop systems mutually compatible so that the greatest use can be made of these admittedly very expensive new devices.

ACCESSORIES *continued*

the re-arrangement of a selection of shorting plugs and inter-connections. These are used in conjunction with metering switches and potentiometers so that the problem parameters can be quickly changed and the dynamic characteristics of the particular control system under study can be examined with the minimum loss of time.

The equipment comprises 12 amplifiers each having a sign reversing amplifier with input and feed-back units built-in. Non-linear facilities include a saturation unit allowing for positive and negative true saturation to be set up independently, two units for dead zone or back-lash and two multipliers, each using two standard amplifiers which are available as extra amplifiers when the multipliers are not in use. The multipliers are accurate to within ± one percent at full deflection.

Six meters are provided for monitoring and a four channel pen recorder, complete with its own amplifiers, is built into the right-hand column of the desk, two pens being operative and the other two being available as extras if required.

The English Electric Company Ltd.
Kidsgrove,
Stoke-on-Trent,
Staffs.

◀ *Left, a Kimball reader, which interprets data punched in the form of micropunched holes in Kimball tickets, and presents this information to orthodox punched card machines which transfer it on to punched cards. A full story on Kimball ticket systems will appear in the October issue of* AUTOMATIC DATA PROCESSING.

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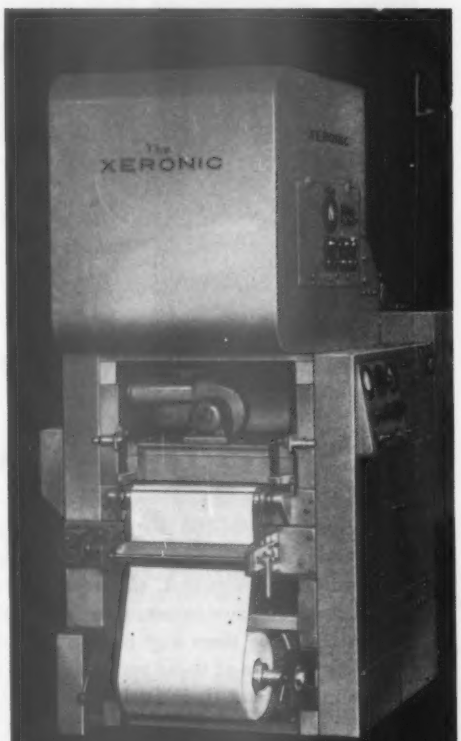

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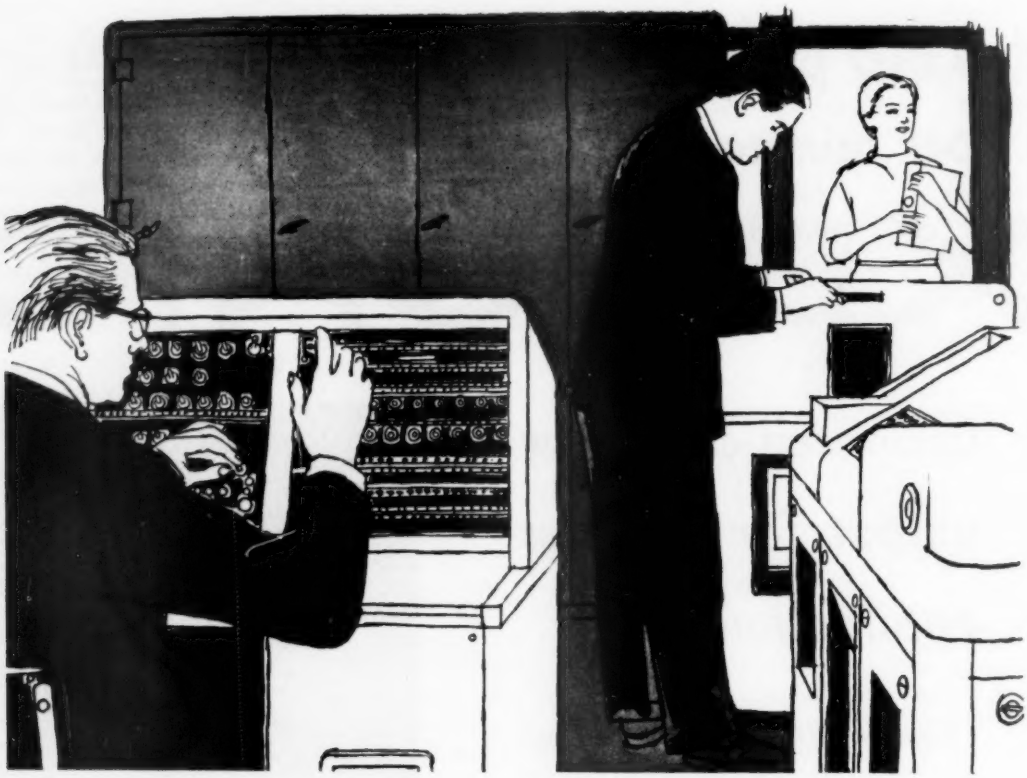

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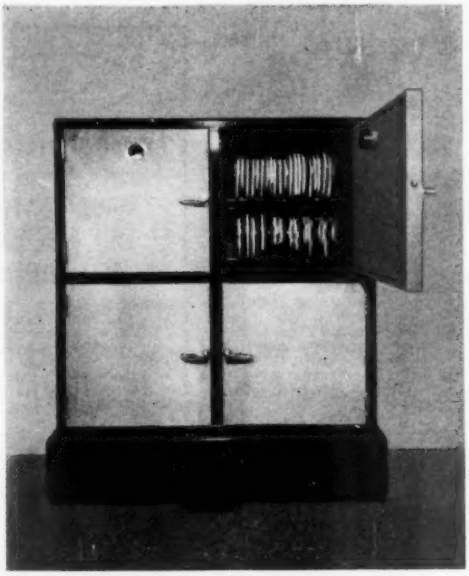

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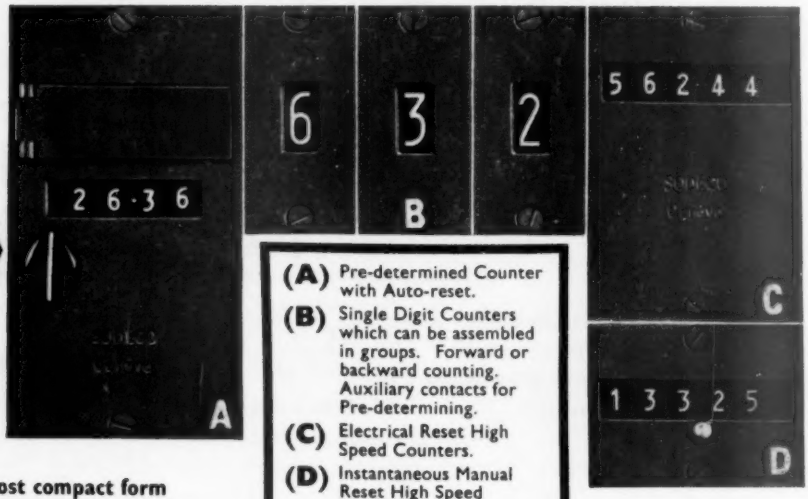

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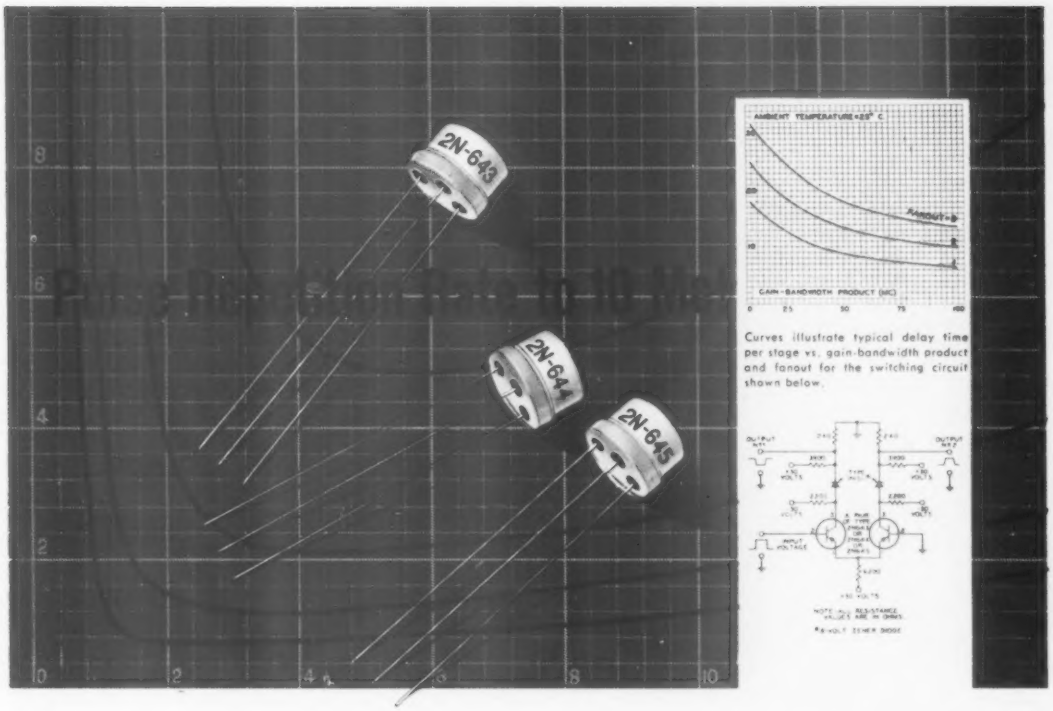

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